1982

INTERNATIONAL PACIFIC SALMON
FISHERIES COMMISSION

APPOINTED UNDER A CONVENTION
BETWEEN CANADA AND THE UNITED STATES FOR THE
PROTECTION, PRESERVATION AND EXTENSION OF
THE SOCKEYE AND PINK SALMON FISHERIES
IN THE FRASER RIVER SYSTEM

ANNUAL REPORT

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National Marine Fisheries Service
2570 Dole Street
Honolulu, Hawaii

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C. WAYNE SHINNERS
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WILLIAM G. SALETIC
HERBERT A. LARKINS
ROLLAND A. SCHMITTEN

NEW WESTMINSTER
CANADA
1983

INTERNATIONAL PACIFIC SALMON
FISHERIES COMMISSION

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Senator Thomas Reid	1937-1967
A. J. Whitmore	1939-1966
	1968-1969
Olof Hanson	1948-1952
H. R. MacMillan, C.B.E.,D.Sc.	1952-1956
F. D. Mathers	1956-1960
W. R. Hourston	1960-1981
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C. Wayne Shinners	1981-
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Milo Moore	1946-1949
	1957-1961
Albert M. Day	1947-1954
Alvin Anderson	1949-1950
Robert J. Schoettler	1951-1957
Elton B. Jones	1951-1957
Arnie J. Suomela	1954-1961
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George C. Starlund	1961-1966
Clarence F. Pautzke	1961-1969
Thor C. Tollefson	1966-1975
Charles H. Meacham	1969-1970
Donald R. Johnson	1971-1980
William G. Saletic	1974-
Donald W. Moos	1975-1977
Gordon Sandison	1977-1980
Herbert A. Larkins	1980-
Rolland A. Schmitten	1981-

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DIRECTOR - JOHN F. ROOS

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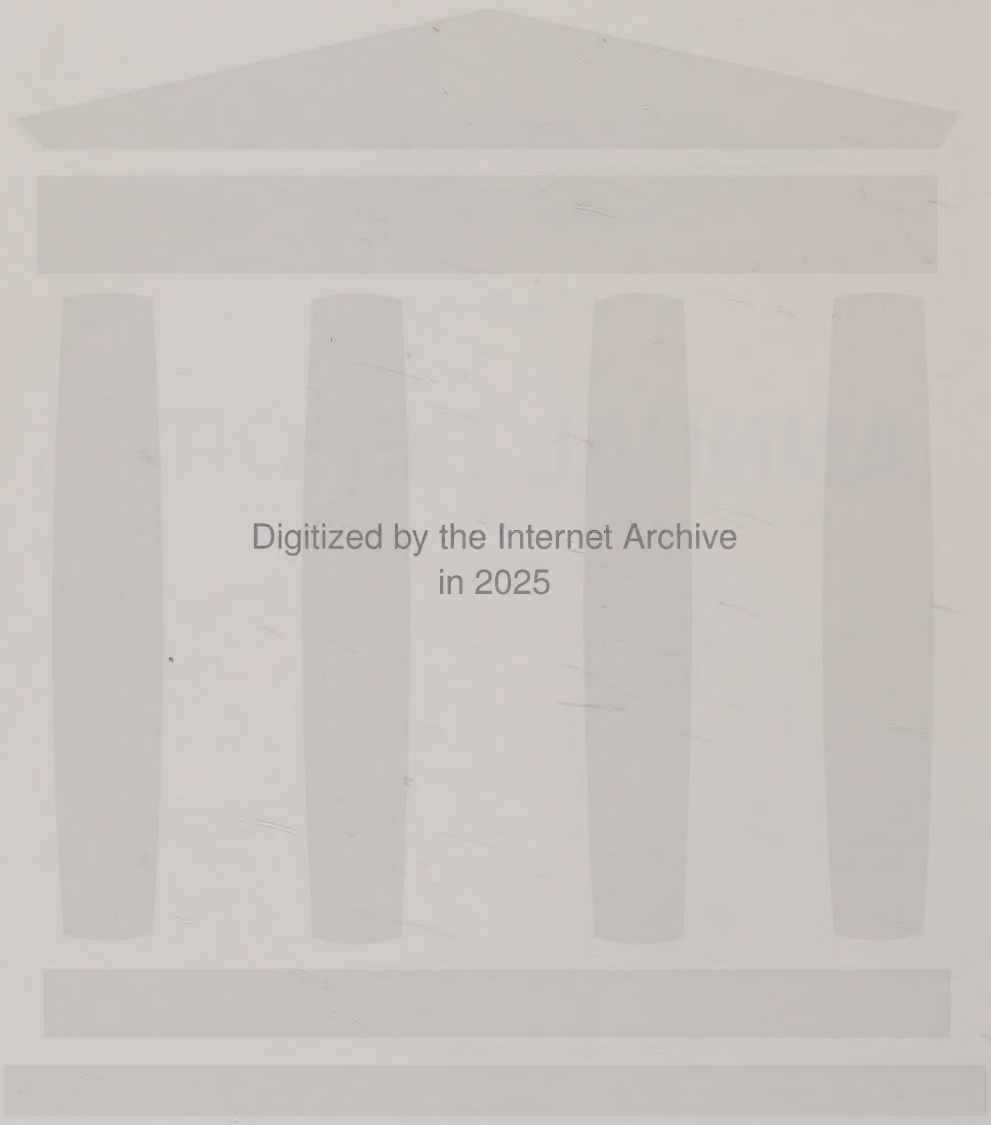

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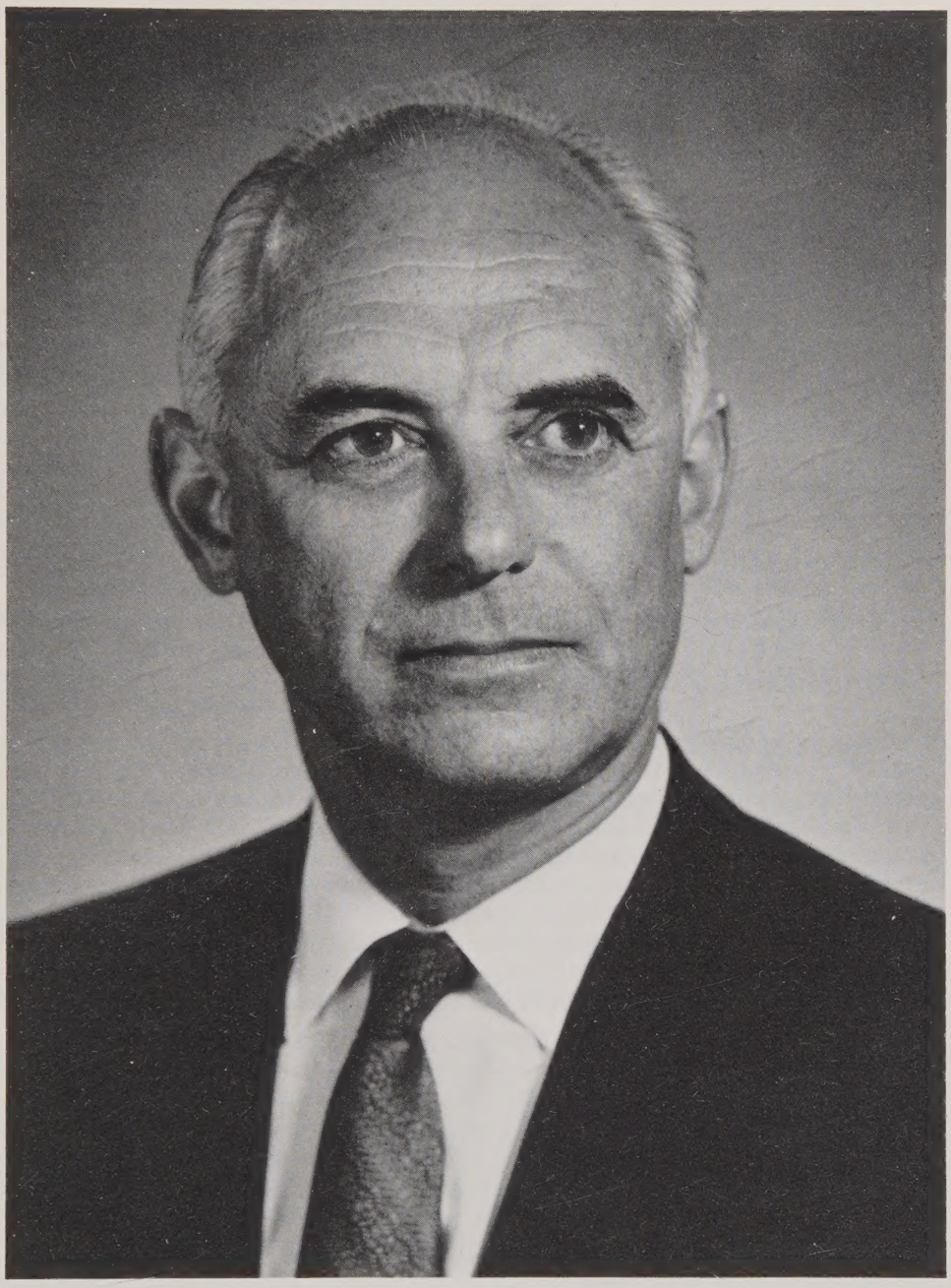

A. C. Cooper

Director of Investigations of the International Pacific Salmon Fisheries Commission from 1971 until his retirement in March, 1982. Mr. Cooper started his career with the Commission in 1942 and became a permanent staff member in 1944 as a Junior Engineer. He was appointed Chief Engineer in 1957 and Director in 1971. Mr. Cooper implemented policies that produced substantial improvement of Fraser River sockeye and pink salmon stocks.

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REPORT OF THE INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION FOR THE YEAR 1982

This year marked the culmination of nine complete cycles of management by the Commission on Fraser River sockeye since 1946. Also, thirteen return cycles of Fraser River pink salmon have been managed by the Commission beginning in 1957. During the entire period that runs were affected by Hell's Gate slide, 1917 to 1946, the annual Fraser River sockeye run averaged only about 3,000,000 fish. Since that time, returns of the various races have increased significantly and during the last four years (1979-1982) the annual run of Fraser sockeye has been 7.8 million fish, about 2.5 times the size of the runs in the period of depletion prior to 1946. The average run during the last four years can be compared with estimated average annual runs of about 10 to 12 million during the period 1894-1916, prior to the effect of Hell's Gate slide.

Significant improvement in the production of Fraser River pink salmon has also occurred in recent years. From 1959 to 1963 the average Fraser River pink salmon run was only 4.6 million fish. The average total run increased to 13.6 million fish during the period 1977-1981. In 1981 the total return reached 18,400,000 fish, the largest run since 1913. The escapement alone in 1981 was 4.5 million fish.

During the period from 1946-1982 for sockeye and from 1957-1981 for pink salmon of all stocks, United States fishermen have taken in Convention Waters, 61,673,000 sockeye and 31,410,000 pink salmon. Canadian fishermen have caught 60,760,000 sockeye and 31,126,000 pink salmon. The total commercial catch of Fraser River sockeye and pink salmon by fishermen in all fisheries for the same time periods as mentioned above are for Canada, 92,416,000 sockeye and 50,180,000 pinks, and for United States fishermen, 61,431,000 sockeye and 27,174,000 pink salmon. In addition, from 1946-1982, a total of 5,550,000 Fraser sockeye have been taken in the Indian fishery in the Fraser River and tributaries thereto. An estimated 428,000 pink salmon have been taken in this same fishery during the period 1957-1981.

During the period 1937-1982, the United States Government has contributed $15,479,683 towards funding the Commission's programs and the Canadian Government, $15,614,752. In terms of value of catch in all commercial fishing areas of Fraser fish during years of Commission management of both species, it is calculated that Canadian fishermen have received $346,637,000 for sockeye and $85,830,000 for pink salmon, while United States fishermen have received $222,525,000 for sockeye and $44,678,000 for pink salmon.

The increased productivity of Fraser River sockeye and pink salmon runs is the result of improving access to the spawning grounds at several locations through fishway construction, scientific management of the commercial fishery, and protection of the habitat. These measures have, since 1946, resulted in increased total runs and catch by

fishermen of the two countries. These efforts have also resulted in dramatic increases in several races. The Horsefly River race in 1941 was on the threshold of extinction with the total run less than 5,000 fish (1,000 escapement). By 1981 this population had been restored to total run of 4,100,000 adult sockeye (750,000 escapement). The dominant year Early Stuart run in 1973 and 1977 was increased to about 1,350,000 fish each cycle, the largest runs on record and possibly the largest ever to the system. In 1937 this race had only a 7,500 fish total return. The Lower Shuswap River run in 1950 produced a total run of 25,000 sockeye with an escapement of 12,000 spawners. Steady cycle year increases resulted in a 1982 return of 1,630,000 fish with escapement of 514,000 spawners.

Other smaller races such as the early run to Scotch Creek have increased dramatically. In 1961 this population was less than 2,000 fish (total run) with escapement of only 598 fish. By 1981, just five cycles later, the stock produced about 103,000 fish in total with an escapement of almost 19,000 adults. The Mitchell River run which is tributary to Quesnel Lake had only 41 spawners (200 total run) in 1941 and by 1981 the escapement had increased to 66,106 spawners from a total run of approximately 360,000 fish. Other stocks such as Fennell Creek, Chilko Lake (south end) and Middle Shuswap River spawners have also shown large increases.

The Weaver Creek sockeye run in the mid 1960's was in serious jeopardy because of the effects of environmental degradation. A low point was reached in 1964 when the escapement dropped to only 1,370 spawners. The average total annual return was estimated at 9,000 fish during the period 1961-1964. Following construction of the spawning channel in 1965, the Weaver Creek run has been restored to record levels of production. The culmination of the recovery was the remarkable return of an estimated 960,000 Weaver Creek sockeye in 1982, the largest run on record and probably the largest ever. During the four year period (1979-1982) the annual return has averaged about 388,000 sockeye.

The six spawning-incubation channel facilities constructed by the Commission from 1961 through 1973 have played a major role in increasing production of the various races involved but they have not been a major factor in the total production in recent years, which is due to the improved status of many "un-enhanced" wild stocks. For example, from 1978 through 1982 for sockeye salmon, these channels have accounted for only 5.72% of the total adult production of all races and for pink salmon in 1981, only 6.8% of the total number of pink salmon returning to the Fraser system.

Many stocks such as Horsefly and Lower Shuswap River sockeye have large potential production and can be expected to continue to increase. The only major watershed areas in need of an enhancement facility, such as spawning channels, would be the Stuart and Francois Lake systems. With regard to pink salmon, there is a need to assist some of the late run stocks if these populations are to be returned to historic levels of productions. With vigorous habitat protection, future production of Fraser River sockeye and pink salmon can be expected to increase.

COMMISSION MEETINGS

The International Pacific Salmon Fisheries Commission held fourteen formal and fifteen telephone meetings during 1982 with the approved minutes of the meetings being submitted to the Governments of Canada and the United States.

On June 3 the Commission approved the reappointment of Mr. Tom Philpott to the Advisory Committee representing United States Reef Net Fishermen. At the July 23

meeting the Commission approved the reappointment of Mr. John Brajcich to the Advisory Committee representing Canadian Purse Seine Fishermen. On December 1 the Commission approved the appointments of the following United States Advisory Committee members: Mr. R. Suggs representing Gill Net Fishermen and Mr. C. Finley representing Troll Fishermen.

The membership of the Advisory Committee for 1982 was as follows:

United States	*Canada*
W. Green Purse Seine Fishermen	J. Brajcich Purse Seine Fishermen
J. Lind Salmon Processors	B. Fraser Salmon Processors
R. Christensen (to Dec. 9) R. Suggs (from Dec. 10) Gill Net Fishermen	F. Nishii Gill Net Fishermen
T. Philpott Reef Net Fishermen	N. Carr Purse Seine Crew Members
W. Kimzey (to Dec. 9) C. Finley (from Dec. 10) Troll Fishermen	J. Makowichuk Troll Fishermen
E. Engman Sports Fishermen	A. Downs Sports Fishermen
C. Peterson Native Indian Fishermen	D. Guerin Native Indian Fishermen

The first meeting of 1982 was held January 22 with Mr. W. G. Saletic serving as Chairman and Mr. A. W. Dixon as Vice Chairman and Secretary. The Commission met with its Advisory Committee regarding tentative recommendations for regulatory control of the 1982 sockeye salmon fishery in Convention Waters, as submitted to the Committee on December 11, 1981. After certain regulatory revisions, the Commission approved the recommended regulations for submission to the two national governments. The Commission accepted the notice of retirement of the Director, Mr. A. C. Cooper, effective March 31, 1982, and appointed Mr. John F. Roos as Director of Investigations. The Commission elected Mr. A. W. Dixon as Chairman and Mr. R. A. Schmitten as Vice Chairman and Secretary.

At its meeting of June 3 the Commission approved a revised budget for 1982-83 and the budget request for fiscal year 1983-84. A draft of the 1981 Annual Report was approved and other administrative matters were discussed. The Commission reviewed proposed restrictions in Fraser River Indian fisheries during the Early Stuart run.

On June 18 the Commission met with officials of both national governments and discussed the document entitled "Agreement between Canada and the United States of America for the Management of Pacific Salmon."

During the period July 23 through October 8, the Commission held nine formal and fifteen telephone meetings for adjustments of fishing regulations to achieve the desired escapement and, as nearly as practicable, equitable division of the allowable catch of Fraser River sockeye. On October 15 the Commission, accompanied by former Commissioners and members of the Advisory Committee, inspected the sockeye spawning in the Adams River and adjacent areas of the Shuswap Lake system.

The Commission met December 1 to review the Annual Meeting presentation. The fourteenth and final formal meeting of the year was held on December 10 in Bellingham, Washington, when the Commission held its Annual Meeting with its Advisory Committee and approximately 250 representatives of industry, government and press.

A review of events during the 1982 sockeye salmon season was presented by the Chairman. The catch and escapement statistics were also given by the staff. Prospects for the 1983 fishing season were reviewed and tentative regulations for the 1983 fishery were proposed for consideration by industry and their representatives on the Commission Advisory Committee.

1982 REGULATIONS

Recommendations for regulations governing the 1982 sockeye salmon fishery in Convention Waters were adopted at a meeting of the Commission held January 22, 1982 and were submitted to the two national governments for approval on February 25, 1982. On April 6, 1982 the United States Government informed the Commission that its recommended 1982 regulations were approved with the exception that certain Treaty Indians were excluded and would be regulated under separate United States regulations. The National Marine Fisheries Service was designated as the enforcing agency in cooperation with other federal agencies. The recommendations for Canadian Convention Waters were implemented during the fishing season under the Fisheries Act, Pacific Commercial Salmon Fishery Regulations.

The recommendations of the Commission were as follows:

Canadian Convention Waters

"The International Pacific Salmon Fisheries Commission appointed pursuant to the Convention between Canada and the United States of America for the protection, preservation and extension of the Sockeye Salmon Fisheries of the Fraser River System, signed at Washington on the 26th day of May, 1930, as amended by the Pink Salmon Protocol signed at Ottawa on the 28th day of December, 1956, hereby recommends to the Canadian Government that, in the interest of such fisheries, the following Fraser River Sockeye and Pink Salmon Fishery Regulations for Convention Waters for the season of 1982 be adopted by Order-in-Council pursuant to Section 34 of the Fisheries Act, namely:

1. (1) No person shall fish for sockeye or pink salmon in the waters of the southerly portion of District No. 3 in that portion of Area 20 lying westerly of a line drawn true south from Sheringham Point Lighthouse to the International Boundary from the 20th day of June, 1982 to the 7th day of August, 1982, both dates inclusive.

(2) No person shall fish for sockeye or pink salmon with purse seines in the waters described in subsection (1) of this section:

(a) From the 8th day of August, 1982 to the 4th day of September, 1982, both dates inclusive, except from half past six o'clock in the forenoon to half past six o'clock in the afternoon of Monday of each week; and

(b) From the 5th day of September, 1982 to the 11th day of September, 1982, both dates inclusive, except from seven o'clock in the forenoon to seven o'clock in the afternoon of Monday.

(3) No person shall fish for sockeye or pink salmon with gill nets in the waters described in subsection (1) of this section:

(a) From the 8th day of August, 1982 to the 4th day of September, 1982, both dates inclusive, except from half past six o'clock in the afternoon of Sunday to half past six o'clock in the forenoon of Monday of each week; and

(b) From the 5th day of September, 1982 to the 11th day of September, 1982, both dates inclusive, except from seven o'clock in the afternoon of Sunday to seven o'clock in the forenoon of Monday.

(4) No person shall troll commercially for sockeye or pink salmon in the waters described in subsection (1) of this section from the 8th day of August, 1982 to the 11th day of September, 1982, both dates inclusive, except at times that net fishing may be permitted within that area.

2. No person shall fish for sockeye or pink salmon with nets in the waters of the southerly portion of District No. 3 embraced in Areas 17 and 18:

(1) From the 20th day of June, 1982 to the 24th day of July, 1982, both dates inclusive; and

(2) From the 25th day of July, 1982 to the 14th day of August, 1982, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday of each week; and

(3) From the 15th day of August, 1982 to the 2nd day of October, 1982, both dates inclusive.

3. No person shall fish for sockeye or pink salmon with gill nets in District No. 1:

(1) From the 20th day of June, 1982 to the 24th day of July, 1982, both dates inclusive; and

(2) From the 25th day of July, 1982 to the 4th day of September, 1982, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday of each week; and

(3) From the 5th day of September, 1982 to the 11th day of September, 1982, and from the 26th day of September, 1982 to the 2nd day of October, 1982, all dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday, in those waters lying westerly of a line projected from Point Grey to the westerly end of the North Arm Jetty, thence to Sand Heads Light, thence to Canoe Pass Buoy, thence to the light on the westerly end of Tsawwassen Causeway and thence to the Point Roberts Light in the State of Washington; and

(4) From the 12th day of September, 1982 to the 25th day of September, 1982, both dates inclusive; and

(5) From the 3rd day of October, 1982 to the 9th day of October, 1982, both dates inclusive, except from eight o'clock in the forenoon to eight o'clock in the afternoon of Monday, in the following described waters:

(a) In the Main Arm upstream from a straight line projected north and south magnetic through Woodwards Training Wall West Light near Steveston; and

(b) In Canoe Pass upstream from a line projected north and south magnetic through Brunswick Cannery; and

(c) In the North Arm upstream from Oak Street Bridge.

4. No person shall troll commercially for sockeye or pink salmon in those portions of the waters described in sections 2 and 3 lying easterly of a line from Reception Point to Orlebar Point on Gabriola Island, thence along the easterly shoreline of Gabriola Island to Josef Point, thence in a straight line to Cordero Point on Valdez Island and along the easterly shoreline of Valdez Island to Vernaci Point, thence in a straight line to Race Point on Galiano Island and along the easterly shoreline of Galiano Island to Burrill Point, thence in a straight line to Georgina Point on Mayne Island, thence along the easterly shoreline of Mayne Island to Campbell Point, thence in a straight line to Winter Point on Saturna Island, thence along the easterly shoreline of Saturna Island to East Point, thence due south to the International Boundary, from the 15th day of August, 1982 to the 25th day of September, 1982, both dates inclusive, except at the times and locations that net fishing may be permitted within that area.

5. No person shall troll commercially for sockeye or pink salmon in those portions of the waters described in sections 2 and 3 lying east and south of a straight line projected from Gower Point at the westerly entrance to Howe Sound to Thrasher Rock Light, thence in a straight line to Salamanca Point on the southerly end of Galiano Island, thence in a straight line to East Point on Saturna Island, thence due south to the International Boundary, from the 26th day of September, 1982 to the 2nd day of October, 1982, both dates inclusive, except at the times and locations that net fishing may be permitted within that area.

All times hereinbefore mentioned shall be Pacific Daylight Saving Time."

United States Convention Waters

"The International Pacific Salmon Fisheries Commission appointed pursuant to the Convention between Canada and the United States of America for the protection, preservation and extension of the Sockeye Salmon Fisheries of the Fraser River System, signed at Washington on the 26th day of May, 1930, and amended by the Pink Salmon Protocol signed at Ottawa on the 28th day of December, 1956, hereby recommends to

the United States Government that regulations to the following effect, in the interests of such fisheries in Convention Waters, be adopted for the year 1982, and that an approved copy of said regulations be forwarded to the Director of Fisheries of the State of Washington for implementation by virtue of authority in him vested by Section 6 of Chapter 112 of the Laws of the State of Washington of 1949, namely:

1. No person shall fish for sockeye or pink salmon with nets from the 20th day of June, 1982 to the 24th day of July, 1982, both dates inclusive.

2. (1) No person shall fish for sockeye or pink salmon with purse seines in Puget Sound Salmon Management and Catch Reporting Areas 4B, 5, 6, 6A, 6C, 7, 7A, 7B and 7D:

(a) From the 25th day of July, 1982 to the 14th day of August, 1982, both dates inclusive, except from five o'clock in the forenoon to half past nine o'clock in the afternoon of Monday of each week; and

(b) From the 15th day of August, 1982 to the 11th day of September, 1982, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Monday of each week.

(2) No person shall fish for sockeye or pink salmon with reef nets in the waters described in subsection (1) of this section:

(a) From the 25th day of July, 1982 to the 31st day of July, 1982, and from the 8th day of August, 1982 to the 14th day of August, 1982, all dates inclusive, except from seven o'clock in the forenoon to half past nine o'clock in the afternoon of Sunday of each week; and

(b) From the 1st day of August, 1982 to the 7th day of August, 1982, both dates inclusive, except from seven o'clock in the forenoon to eight o'clock in the afternoon of Sunday; and

(c) From the 15th day of August, 1982 to the 21st day of August, 1982, and from the 29th day of August, 1982 to the 4th day of September, 1982, all dates inclusive, except from six o'clock in the forenoon to half past seven o'clock in the afternoon of Sunday of each week; and

(d) From the 22nd day of August, 1982 to the 28th day of August, 1982, and from the 5th day of September, 1982 to the 11th day of September, 1982, all dates inclusive, except from seven o'clock in the forenoon to nine o'clock in the afternoon of Sunday of each week.

(3) No person shall fish for sockeye or pink salmon with gill nets in the waters described in subsection (1) of this section:

(a) From the 25th day of July, 1982 to the 31st day of July, 1982, and from the 8th day of August, 1982 to the 14th day of August, 1982, all dates inclusive, except from seven o'clock in the afternoon of Monday to half past nine o'clock in the forenoon of Tuesday of each week; and

(b) From the 1st day of August, 1982 to the 7th day of August, 1982, both dates inclusive, except from seven o'clock in the afternoon of Sunday to half past nine o'clock in the forenoon of Monday; and

(c) From the 15th day of August, 1982 to the 21st day of August, 1982, and from the 29th day of August, 1982 to the 4th day of September, 1982, all dates inclusive, except from six o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Monday of each week; and

(d) From the 22nd day of August, 1982 to the 28th day of August, 1982, and from the 5th day of September, 1982 to the 11th day of September, 1982, all dates inclusive, except from six o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday of each week.

3. No person shall fish for sockeye or pink salmon with commercial trolling gear in the waters of Puget Sound Salmon Management and Catch Reporting Areas 4B, 5 and 6C from the 25th day of July, 1982 to the 11th day of September, 1982, both dates inclusive, except from Monday through Friday of each week on those days when purse seine fishing is permitted within that area.

4. No person shall fish for sockeye or pink salmon with nets in that portion of Puget Sound Salmon Management and Catch Reporting Area 7B easterly of a line drawn from the southern tip of Lummi Peninsula, thence to the northwestern tip of Portage Island, thence following the westerly shoreline of Portage Island to the highest promontory of Point Frances, thence in a straight line to the red buoy at the northern end of Eliza Island, thence in a straight line to the northern tip of Eliza Island, thence along the eastern shoreline of Eliza Island to Eliza Rock Light, thence in a straight line to the northern tip of Vendovi Island, thence following the established boundary of Area 7B to March Point on Fidalgo Island,

except for those sockeye or pink salmon taken in gill nets having mesh of not less than 7½ inches as authorized for the taking of chinook salmon by the Director of Fisheries of the State of Washington, from the 25th day of July, 1982 to the 4th day of September, 1982, both dates inclusive.

5. (1) No person shall fish for sockeye or pink salmon with nets in that portion of the waters described in subsection (1) of section 2 lying northerly and westerly of a straight line drawn from Iwersen's Dock on Point Roberts in the State of Washington to Georgina Point Light at the entrance to Active Pass in the Province of British Columbia from the 29th day of August, 1982 to the 4th day of September, 1982, and from the 3rd day of October, 1982 to the 9th day of October, 1982, all dates inclusive.

(2) No person shall fish for sockeye or pink salmon with nets in that portion of the waters described in subsection (1) of section 2 lying westerly of a straight line drawn from the low water range marker in Boundary Bay on the International Boundary through the east tip of Point Roberts in the State of Washington to the East Point Light on Saturna Island in the Province of British Columbia from the 5th day of September, 1982 to the 2nd day of October, 1982, both dates inclusive.

6. The foregoing recommended regulations shall not apply to the following waters:

(1) Puget Sound Salmon Management and Catch Reporting Areas 6B, 6D and 7C.

(2) Preserves previously established by the Director of Fisheries of the State of Washington for the protection of other species of food fish.

All times hereinbefore mentioned shall be Pacific Daylight Saving Time."

Emergency Orders

In order to provide for adequate racial escapement of Fraser River sockeye salmon and for an equitable share of the season's catch by fishermen of the United States and Canada, and to facilitate the Pacific Fishery Management Area regulation of Canada Department of Fisheries and Oceans, the approved regulations as detailed above were later adjusted by the Commission as follows:

June 3, 1982 — In the interest of consistency with regulations promulgated by the United States regarding troll fishing, the Commission approved the following regulations for United States Waters: "no person shall fish for sockeye or pink salmon by commercial trolling gear in that portion of Convention Waters westerly of a straight line drawn from Tatoosh Island Lighthouse in the State of Washington to Bonilla Point in the Province of British Columbia comprising the Territorial waters of the United States and those High Seas waters contained in the United States Fishery Conservation Zone from the 4th day of June, 1982 to the 14th day of July, 1982, both dates inclusive".

July 23, 1982 — At the request of Canada Department of Fisheries and Oceans and Washington State Department of Fisheries the Commission approved the following regulations: 1) That Areas 17 and 18 of Canadian Convention Waters remain closed to net fishing for the remainder of the season. 2) That Area 29 of Canadian Convention Waters open to gill nets and trollers on July 26 for 1 day of fishing. 3) That Area 7B of United States Convention Waters be closed to fishing from July 25 to September 4, both dates inclusive, except with nets having a mesh of not less than 7 inches under regulation by the Washington State Director of Fisheries.

July 30, 1982 — In order to secure additional escapement of summer-run sockeye the Commission approved the following regulatory changes: 1) That Area 29 of Canadian Convention Waters open to gill nets and trollers on August 3 for 1 day of fishing. 2) That the scheduled fishing in United States Convention Waters be delayed 1 day for 1 day of fishing for the week commencing August 1.

August 6, 1982 — In the interest of harvesting Chilko River sockeye the Commission approved the following regulatory changes: 1) That Area 20-1, 3 and 4 of Canadian Convention Waters open as scheduled but for 2 days of fishing. 2) That the scheduled fishing in United States Convention Waters be delayed 1 day. 3) That Area 29 of Canadian Convention Waters remain closed to net fishing until further notice.

August 9, 1982 — In order to harvest midsummer sockeye runs the Commission approved opening Area 29 of Canadian Convention Waters to gill nets and trollers for 1 day of fishing on August 11.

August 13, 1982 — In the interest of harvesting Adams River sockeye the Commission approved the following regulatory changes: 1) That Area 20-1, 3 and 4 of Canadian Convention Waters open as

scheduled but for 2 days of fishing. 2) That United States Convention Waters lying easterly and southerly of the Iwersen's Dock Line open as scheduled but for 2 days of fishing. 3) That Area 29-1 to 4 and 6 to 17 of Canadian Convention Waters open to gill nets and trollers for 1 day of fishing on August 16. 4) That Area 29-5 of Canadian Convention Waters be closed to fishing from August 15 to September 25. 5) That Areas 18-1 and 17-10 of Canadian Convention Waters be closed to trolling from August 15 to September 25.

August 19, 1982 — In order to harvest additional Chilko River sockeye the Commission approved opening Area 29-7 and 9 to 17 of Canadian Convention Waters to gill nets on August 20 for 12 hours of fishing.

August 20, 1982 — In the interest of harvesting Adams River sockeye the Commission approved the following regulatory changes: 1) That the opening of Area 20-1, 3 and 4 of Canadian Convention Waters be advanced 1 day for 2 days of fishing. 2) That United States Convention Waters open as scheduled with the waters westerly and northerly of Iwersen's Dock closed. 3) That Area 29-1 to 4 and 6 to 17 of Canadian Convention Waters open to gill nets and trollers on August 23 for 1 day of fishing.

August 27, 1982 — In the interest of division of catch the Commission approved the following regulatory changes: 1) That Area 20-1, 3 and 4 and Area 29-1 to 4 and 6 to 17 of Canadian Convention Waters not open as scheduled for the week commencing August 29. 2) That the opening of United States Convention Waters be advanced 1 day for 1 day of fishing.

August 31, 1982 — In the interest of division of catch the Commission approved the following regulatory changes: 1) That Area 29-7 and 9 to 17 of Canadian Convention Waters open to gill nets on September 1 for 12 hours of fishing. 2) That United States Convention Waters lying southerly and easterly of the east Point Roberts — East Point Line would reopen September 2 for 1 day of fishing.

September 1, 1982 — In the interest of protecting delaying Adams River sockeye the Commission approved that Area 7A of United States Convention Waters be closed to fishing effective 3:00 p.m. September 1.

September 3, 1982 — In the interest of division of catch and escapement, the Commission approved the following regulatory changes: 1) That regulatory control of Area 20 of Canadian Convention Waters and Areas 4B, 5 and 6C of United States Convention Waters be relinquished effective 12:01 a.m. September 5 one week earlier than scheduled. 2) That the opening in United States Convention Waters be delayed 1 day for 1 day of fishing with Area 7A remaining closed. 3) That Area 29-1 to 4 and 6 to 17 open to gill nets and trollers at 7:00 a.m. September 7 for 12 hours of fishing.

September 10, 1982 — Due to the declining numbers of sockeye the Commission relinquished regulatory control of Areas 6, 6A, 7 and 7D of United States Convention Waters effective 12:01 a.m. September 12 but retained control of Area 7A which remained closed.

September 23, 1982 — In the interest of harvesting Adams River sockeye the Commission approved opening Area 29-1 to 6 of Canadian Convention Waters to gill nets and trollers at 12:00 noon September 24 for 1 day of fishing.

September 26, 1982 — In the interest of harvesting Adams River sockeye the Commission approved the following regulatory changes: 1) That Area 29-1 to 6 of Canadian Convention Waters open to gill nets and trollers September 27 for 1 day of fishing. 2) That Area 29-1, 2 and 5 of Canadian Convention Waters be closed to trolling except at times net fishing may be permitted in the area effective 12:01 a.m. September 27. 3) That Area 18-1 of Canadian Convention Waters be closed to trolling effective 12:01 a.m. September 27. 4) That control of United States Convention Waters lying southerly and easterly of the East Point Roberts — East Point Light Line be relinquished effective 12:01 a.m. September 27.

September 28, 1982 — In the interest of harvesting Adams River sockeye the Commission approved opening Area 29-1 to 7 and 9 to 10 of Canadian Convention Waters to gill nets and trollers on September 29 for 1 day of fishing.

September 30, 1982 — Due to the declining numbers of sockeye in some areas and the need for harvesting of Adams River and Weaver Creek sockeye, the Commission approved the following regulatory changes: 1) That all remaining United States Convention Waters under Commission control be relinquished effective 12:01 a.m. October 3. 2) That Areas 17, 18 and 29-5 of Canadian Convention Waters be relinquished effective 12:01 a.m. October 3. 3) That Area 29-7 and 9 to 17 open to gill nets at 7:00 a.m. October 4 for 12 hours of fishing.

The Commission relinquished regulatory control of the remaining Convention Waters effective October 10 as scheduled, thus completing the Commission's regulatory obligations for Convention Waters for the 1982 season.

SOCKEYE SALMON REPORT

The Fishery

The 1982 Fraser sockeye run was approximately 13,933,00 fish compared with the preseason forecast of 10,000,000 sockeye. The run was the largest since 1958 and exceeded the brood year return by 4,503,000 fish. Approximately 10,563,000 Fraser sockeye entered Convention Waters of which 6,138,000 (58.1%) were caught in the commercial fishery, 401,000 (3.8%) by the Indian fishery, and 4,024,000 (38.1%) were recorded on the spawning grounds (see Tables I to VI in Appendix). An estimated total of 3,500 non-Fraser sockeye were also caught in Convention Waters. Catches of Fraser sockeye in non-Convention Waters areas in Johnstone Strait and northern Strait of Georgia and in coastal waters north of Convention Waters, were estimated at 1,811,000 and 1,559,000 sockeye, respectively.

The 1982 catch in Convention Waters totaled 6,141,000 sockeye, an increase of 3,462,000 fish over the 1978 brood year catch. The increase in Convention Waters catch resulted from the larger total run and a lower exploitation of Fraser sockeye outside Convention Waters (Figure 1). Unusually high rates of migration via Johnstone Strait in the period 1978 to 1981 led directly to large removals in that fishery. Migration of sockeye via Johnstone Strait in 1982 was estimated to be 22% of the return compared with approximately 58% in 1978. The Johnstone Strait fishery catch of 1,811,000 sockeye was approximately one half the catch of 3,447,000 fish in 1978.

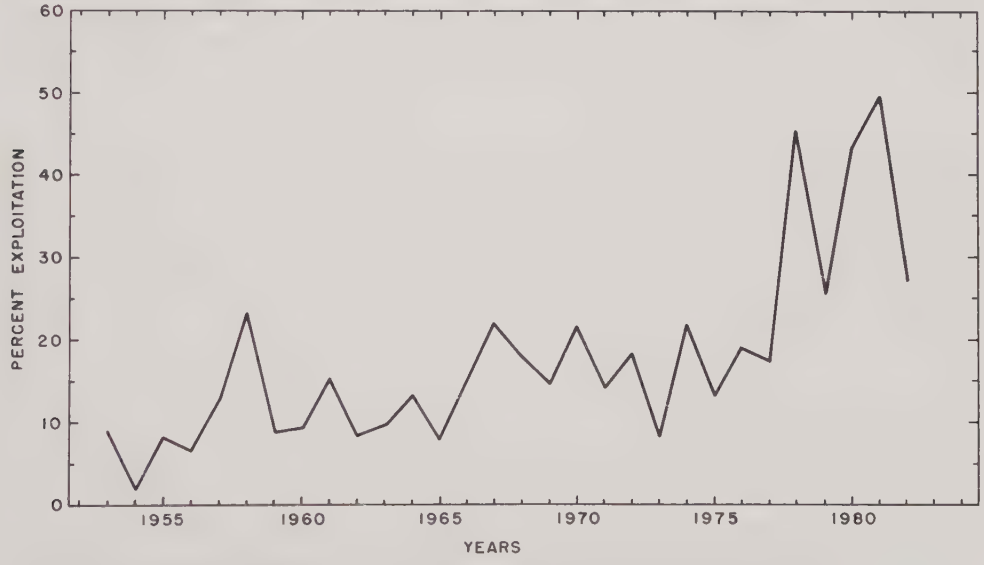

FIGURE 1. Combined exploitation of Fraser River sockeye outside of Convention Waters and in the Fraser River Indian fishery.

Whereas the 1982 catch in Johnstone Strait was lower than the previous cycle (1978), intense fishing effort was directed at sockeye by troll fishermen operating off the west coast of Vancouver Island. As many as 1,100 trollers were sighted by Department of Fisheries and Oceans survey on an individual day with the majority targeting on sockeye. The season coastal troll catch of 2,179,000 Fraser sockeye, 727,000 of which

were taken in Convention Waters, constituted 22.9% of the commercial catch of Fraser sockeye, more than double the 11.1% and 10.6% catch rates recorded in 1974 and 1978, respectively, the two previous high years of catch. Thus, while the diversion of sockeye via Johnstone Strait returned to a near normal level in 1982 the proportion of the run reaching Convention Waters was lower than in many previous years due to the large catch by trollers operating north of Convention Waters (Table 1).

TABLE 1. Fraser River sockeye total runs and catches.

	1958	1974	1978	1982
Total Fraser Run	18,780,000	8,616,000	9,480,000	13,933,000
Convention Waters Run	14,450,000	6,931,000	5,424,000	10,563,000
Percent of Run Reaching Convention Waters	76.9	80.4	57.2	75.8
Convention Waters Catch (Percent of Total Run)	10,500,000 (55.9)	4,952,000 (57.5)	2,675,000 (28.2)	6,138,000 (44.1)
Non-Convention Waters Catch (Percent of Total Run)	4,331,000 (23.1)	1,684,000 (19.5)	4,056,000 (42.8)	3,370,000 (24.2)
Total Fraser Catch (Percent of Total Run)	14,831,000 (79.0)	6,636,000 (77.0)	6,730,000 (71.0)	9,508,000 (68.2)

The expansion of fisheries and increased fishing effort outside the Convention area associated with unusually high diversion rates in recent years have resulted in greatly increased levels of catch outside of Commission regulatory control (Figure 1). The 1978, 1980 and 1981 years were extreme values but even with a near normal diversion of sockeye via Johnstone Strait in 1982, the catch in outside fisheries was high. A direct consequence of these catches has been reduced exploitation in the traditional net fisheries in the Convention area.

In the Convention area, Canadian fishermen caught 3,274,000 sockeye (53.3%) and United States fishermen caught 2,867,000 sockeye (46.7%) (Appendix Tables I and II). The unequal catch division was due to the need to harvest excess Adams River and Weaver Creek sockeye delaying near the mouth of the Fraser River (Area 29). Between September 24 and October 4, Canadian fishermen caught 383,000 sockeye in Area 29 after the migration through United States Waters was complete, eliminating the possibility of balancing the catch by further fishing there and, thus, leading to the imbalance of 408,000 sockeye in division of catch.

In Canadian Convention Waters, 2,412,000 sockeye (73.7%) were taken in the waters westerly of William Head. The percentage catch westerly of William Head was the highest on record exceeding by a wide margin the previous high of 63.1% taken in 1970. The troll catch in Area 30-1 to 3 (728,000) was over double the previous record catch of 347,000 sockeye taken in 1974. In addition, the Area 20 catch was the largest since 1958. As a result of the large catches in the waters westerly of William Head, a lower percentage of the catch was made in the Fraser River area. However, troll and gill net catches easterly of William Head totaled 862,000 sockeye, 32% above the long term (1962-78) average catch on the cycle (653,000 fish).

Canadian purse seine catch and percentage catch (1,525,000; 46.6%) were the highest since 1958 (Appendix Table I). Troll catches totaled 825,000 sockeye or 25.2% of the Canadian total, both record high figures for this gear. Gill nets took 925,000 sockeye, slightly above the average catch for the previous 3 cycles (870,000). However, the gill net percentage catch (28.2%) was the lowest for any year on record.

In United States Convention Waters, catches by all gear types increased over 1978, but, while the gill net and reef net catches increased by 75%, the purse seine catch rose by 143%. Purse seines caught 1,687,000 sockeye, 58.8% of the United States catch. This catch was nearly 1,000,000 larger than taken in 1978 and was the largest by purse seines since 1958. Gill net fishermen harvested 1,124,000 sockeye, the largest catch in any year on record for this gear type. The percentage of the United States catch taken by gill nets (39.2%), however, was reduced from the 1978 level of 46.7% and was the lowest for all years since 1974. Reef nets landed 55,000 sockeye (1.9%), substantially up from the 1978 catch of 32,000 fish; however, the percentage catch was the lowest recorded on the cycle.

Catches by gear type within United States Convention Waters have undergone steady changes over the past 20 years (Figure 2). The catch of sockeye by gill nets has increased from approximately 20% in 1960 to the 1979-82 mean of 48%. Reef nets have declined from approximately 8% to 2% of the catch and purse seines have declined from 72% to 50% of the United States harvest. The causes of these trends are several: (1) there has been an increase in gill net vessels over the period, (2) there has been a greater rise in gill net efficiency compared with purse seines, and (3) there has been a predominance of gill nets in the Treaty Indian fleet. Regulations for the two primary gear, gill nets and purse seines, have not changed except for a shortening of the number of days of fishing allowed each week. Therefore, the gradual shift in catch is primarily a domestic matter.

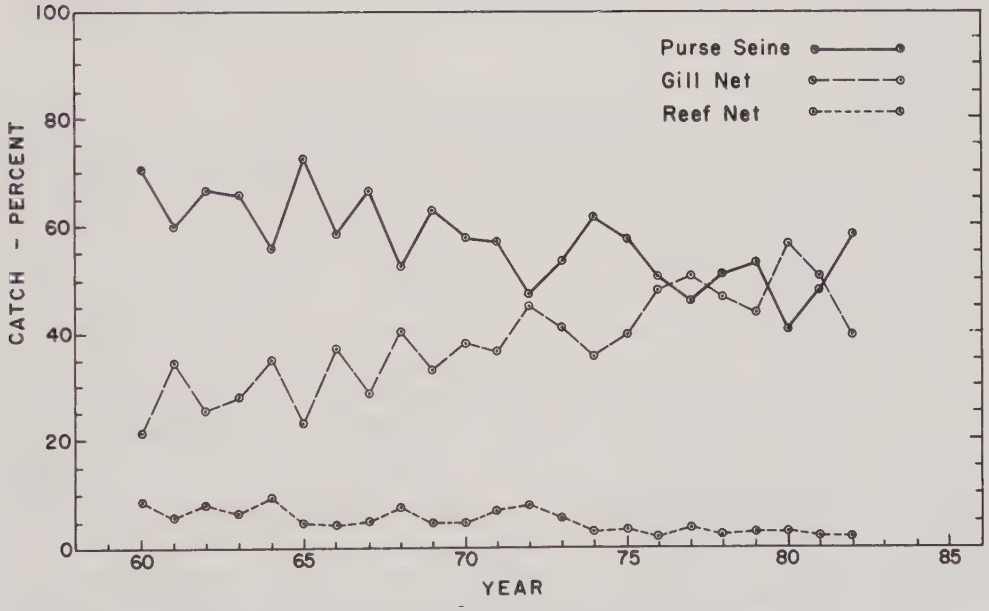

FIGURE 2. Percentage catch by gear in United States Convention Waters, 1960-1982.

The daily maximum number of fishing vessels in United States Convention Waters in 1982 was similar to 1978 and below 1974 levels (Table 2). Some vessels with opportunity to fish Alaskan waters concentrate their effort there, thus, reducing the fleet fishing Puget Sound. In Canadian Convention Waters, purse seine effort in Area 20 reached a record high of 201 vessels in 1982. This was a four-fold increase over 1978 when about 58% of Fraser sockeye migrated via Johnstone Strait. In that year a maximum of 46 purse seines operated in Area 20.

TABLE 2. Fishing units operating in Convention Waters.

	1974	1978	1982
Canadian Convention Waters			
Purse Seines (Area 20)	133	46	201
Gill Nets	1,000	950	693
	1,133	996	894
United States Convention Waters			
Purse Seines	272	220	246
Gill Nets	1,140	999	992
Reef Nets	54	47	43
	1,466	1,266	1,281

Gill net effort in Canadian Convention Waters was lower in 1982 than in previous cycle years, giving a lower combined units total. As noted previously, an increase in troll effort was apparent in 1982 although an estimate of maximum gear operating in Convention Waters is not available.

Fishing time in Convention Waters was severely restricted in 1982 (Table 3). Major fishing areas were each reduced by 2 days fishing from 1978 levels and were approximately one-half the 1974 times.

TABLE 3. Number of fishing days allowed.

		1974	1978	1982
CANADA:	Area 20	11	8	6
	Area 29	20	14	12
UNITED STATES		19	11*	9*

* Commission Regulations

Treaty Indian fishermen fished for sockeye under United States Department of Interior regulations during the period of Commission control. In addition to fishing time under Commission regulations, United States Government regulations permitted 22 periods of fishing by certain Indian tribes in Areas 6, 6A, 7, 7A and 7D and 33 periods of fishing in Areas 4B, 5 and 6C.

The 1982 cycle returns have historically been dominated by Adams River and other late-timed returns to the South Thompson River watershed. This group of fish, the Adams River-Lower Shuswap River sockeye, produced approximately 9,725,000 sockeye in 1982, an increase of 2,740,000 fish from 1978. Whereas the Adams River run increased 27% to 7,970,000 fish, the Lower Shuswap River run increased dramatically from 690,000 fish in 1978 to 1,630,000 adults in 1982, a 136% increase. The Lower Shuswap percentage contribution to the combined late run Shuswap area production has increased from 2% in 1970 to 17% in 1982. Numerically, production has increased by a factor of 23 in just 3 cycles (Figure 3). Increased production of Lower Shuswap and other associated races reduces the dependence upon the reproductive success of a single population such as the Adams River. A collapse of the run on this cycle in 1962 occurred due to the failure of 1958 brood Adams River fish.

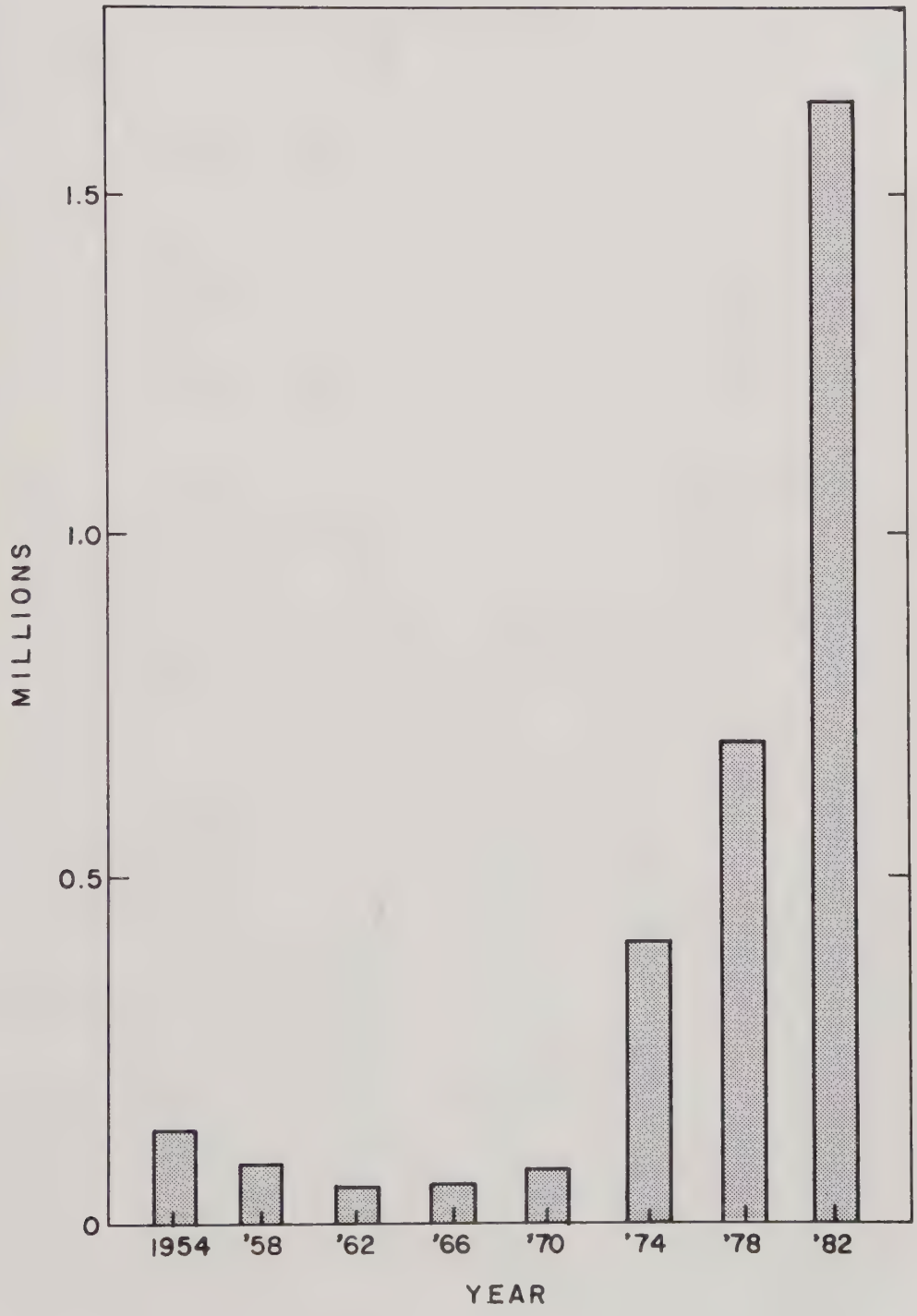

FIGURE 3. Lower Shuswap River sockeye total returns on the dominant cycle, 1954 to 1982.

Associated with excellent returns of Adams River and Lower Shuswap River sockeye were good runs of Chilko, Horsefly, Birkenhead and Weaver sockeye. Summer-run stocks historically have not been large runs on the 1982 cycle. The total return of approximately 3,100,000 fish of these stocks in 1982 exceeds the production recorded in any previous year on the cycle.

The return of Chilko River sockeye was estimated at 1,125,000 fish, 12% above the predicted return. This was the largest Chilko River sockeye production for the cycle back at least to the early 1930's. An additional 53,000 Chilko Lake beach spawning sockeye returned.

Birkenhead sockeye runs in recent years have been largest on the 1974-1982 cycle. The 1982 return was the second largest on record. Weaver Creek sockeye rear in Harrison Lake along with the majority of the Birkenhead fish. The 1982 run of Weaver sockeye was approximately 960,000 fish, over double the largest previous recorded return of this stock. Based on fry emergence estimates, approximately 95% were fish incubated in the spawning channel. The 1978 brood production from Weaver channel was estimated at 40,978,000 fry which gives a survival of 2.3% from fry to adult.

Escapement

The 1982 escapement of 4,024,000 sockeye was the largest recorded in the 45 years of Commission existence. This escapement represented 28.9% of the total run in 1982 compared with the 1978 escapement of 26.5% (2,514,000 fish) (Figure 4).

The Commission has, for several years, attempted to achieve larger, well balanced escapements to the many spawning areas in the Fraser watershed. An increase in escapement in 1978 over the 1974 level led directly to the excellent 1982 return. In 1982, specific attempts were made to increase escapements to Early Stuart streams, Horsefly River, Adams River and Lower Shuswap River. The 1982 preseason goal was for an escapement of 3,100,000 spawners, approximately 600,000 higher than achieved in 1978. The larger than expected return and difficulties in estimating Adams River sockeye escapement into Georgia Strait resulted in the record 4,024,000 spawners.

The escapement goal for Early Stuart sockeye was 70,000 fish based on a preseason prediction of 150,000 total return. The entire commercial fishery directed at Early Stuart fish was closed and only incidental catches were taken. The total run, is now estimated at 100,000 fish, of which approximately 90,000 entered the lower Fraser River. High river discharge combined with above average temperature and turbidity conditions appear to have caused stress on the fish during upstream migration. A significant mortality of Early Stuart fish was detected in the Nechako and Stuart Rivers above Prince George in late July and early to mid-August. Lesions caused by the pathogen *Chondrococcus columnaris* were apparent on many fish. Recorded Indian fishery catches total 45,000 fish, 50% of the gross escapement, despite reductions in fishing time imposed on this fishery between Steveston and Prince George. Only 4,600 Early Stuart sockeye reached the spawning grounds, a reduction of 91% from the 1978 brood year level (Appendix Table VI). The estimated 40,000 fish currently unaccounted for may be attributed to mortalities during migration and to illegal or unreported removals. Regardless of the causes, the disastrously low escapement will require severe restriction in future years on the cycle in order to allow the stock to recover to an exploitable level.

Migration timing of Late Stuart sockeye bring these fish to the river mouth in late July and early August. By this time the Fraser River flow had decreased and, thus, presented generally favorable migration conditions. The Late Stuart escapement increased by 29% to 16,800 spawners.

Late Nadina sockeye migrate upstream in late July after the Early Stuart run but before the Late Stuart sockeye. The Late Nadina escapement was 2,400 fish, a reduction

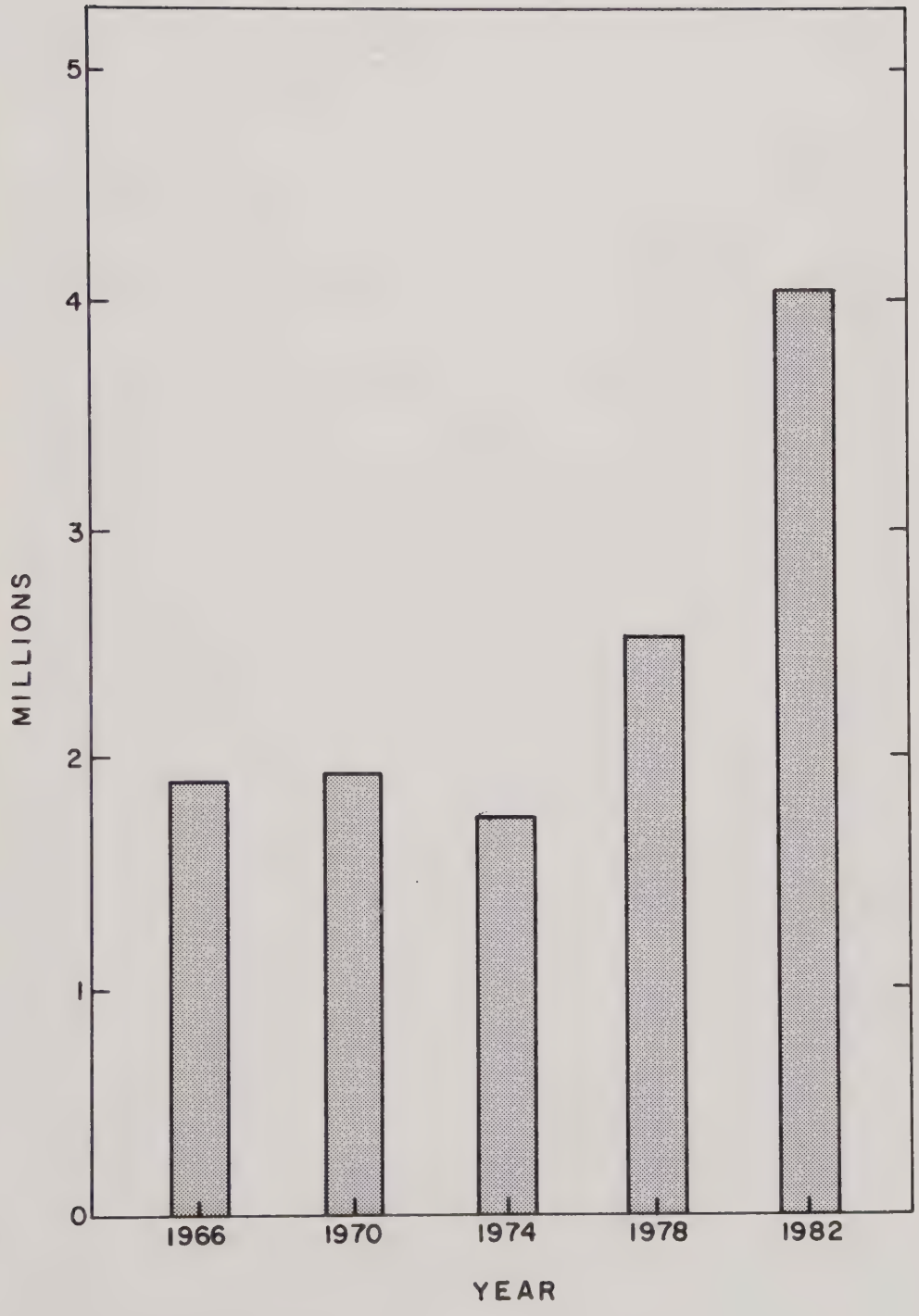

FIGURE 4. Fraser sockeye escapements on the 1966-1982 cycle.

of 16% from the brood year. Estimates of escapement past Mission, B.C. indicated an improved total run, attributable to the Nadina spawning channel. However, recorded Indian fishery catches totaled 6,900 Late Nadina sockeye, 68% of the estimated number passing upstream. Arrival timing suggested that few, if any, early timed fish of this stock arrived in the Indian fishery at Nautley. Stellako River spawners are later timed fish entering this watershed and showed an improved escapement of 69,000 fish, 15% above the 1978 level.

Bowron River sockeye also showed improvement in the escapement into the lower Fraser River. However, the estimated Indian catch was 13,200 fish and only 1,600 spawners were recorded on the spawning grounds, a decrease of 48% from the brood year. Since Bowron, like Late Nadina, are early timed sockeye migrating to the upper reaches of the watershed, there exists the possibility that some stress related mortality also affected these sockeye, similar to Early Stuart fish. Later run Stellako and Late Stuart sockeye showed improved escapements.

Sockeye spawning escapements to the Horsefly River, McKinley Creek and Mitchell River, tributaries to Quesnel Lake, increased five-fold in 1982 to 40,000 fish from 8,600 in 1978. This cycle is the subdominant run to the Horsefly and follows the excellent 1981 run. Approximately 25% of the spawners were 5-year-olds from the successful 1977 brood spawning, but a good return of 1978 brood 4-year-olds was responsible for the larger total escapement. This subdominant cycle escapement was the largest since 1910 or earlier and has increased from only 108 fish in 1946.

Two populations utilize the Chilko River watershed, the Chilko River run and beach spawners at the southern end of Chilko Lake. The escapement of 11,300 lake spawners was 54% above 1978. A substantial increase in Chilko River spawners was obtained from the brood year escapement of 152,000 to a total of 242,000 in 1982. The escapement goal for 1982 was increased in order to maintain a high level of smolt production.

Gates Creek sockeye enter the Seton-Anderson system in July and August while Portage Creek fish migrate in October. The Gates run to the spawning channel and creek totaled 2,200 spawners as compared to 2,600 in the brood year. However, jack sockeye predominate in the escapement on this cycle and the adult population tripled from 258 in 1978 to 871 this year, 81% of which were 5-year-olds from the 1977 brood. All but 250 fish entered the spawning channel. Portage sockeye increased to 24,000 spawners, an increase of 134% over the brood year.

The early runs to tributaries of Shuswap Lake and to Raft River and Fennell Creek in the North Thompson River watershed reached or exceeded brood year escapements. Raft River sockeye spawners increased 20% to 3,000 fish and the Fennell Creek escapement of 1,100 spawners was 69% above 1978. However, the 1978 Fennell Creek return was composed primarily of jacks, thus the 1982 escapement of 1,100 adults was a ten-fold increase. Over 50% of the adults were 5-year-old fish from the 1977 brood, a situation repeated on several streams which have had low returns on the 1982 cycle. Another positive sign in the escapement was the appearance of over 100 fish on the Upper Adams River spawning grounds. Although no spawners were sighted during the 1978 season, the presence of fish near the 1974 egg transplant site suggests some survival and reproduction from that introduction. Seymour River sockeye produced well in 1982 and had an excellent escapement of 63,000 spawners, unchanged from 1978. Scotch Creek sockeye have increased dramatically since 1974 when 500 spawners returned. In 1978 the escapement rose to 2,100 and more than doubled to 4,700 in 1982. In addition to Seymour and Scotch Creeks, sockeye utilize three tributaries to Anstey Arm of Shuswap Lake: Anstey River, Hunakwa Creek and Eagle River and its tributaries. A total of 7,500 spawners were reported from these streams in 1982, up from 1,400 fish in 1978.

Adams River, Little River and associated spawning areas and the Middle and Lower Shuswap River areas had near optimum escapements. The total for these areas was 3,061,000 fish, the largest since 1958. The escapement was somewhat above the preseason goal of 2,500,000 spawners but the distribution of fish was excellent. Whereas the total escapement in the Adams area increased 800,000 fish from the 1978 level of 1,700,000 spawners, the Adams River itself increased 580,000 fish to 2,071,000 spawners. The Adams River thus accounted for 68% of the late run spawners in this system, a drop of 11% from the 1978 level of 79% and the lowest percentage on record. The escapement to Little River increased to 239,000 spawners from 80,000 fish in 1978. Spawning in the South Thompson River increased to 74,000 fish.

The Lower Shuswap and Middle Shuswap populations blossomed in 1982. The Lower Shuswap spawning escapement increased 175% from 187,000 fish in 1978 to 514,000 fish in 1982. The spawning area available in the Lower Shuswap River is as large as in the Adams River. Production and escapement to the Lower Shuswap have increased greatly since 1970. While the total return and escapement in 1982 is most encouraging we have yet to realize the full potential of this race and an increase in escapement in future cycles should be obtained. The Middle Shuswap River escapement increased nearly four-fold from 11,000 to 40,000 spawners, an excellent return.

Escapements to Lower Fraser tributaries showed substantial variation. The spawning populations at Birkenhead River have been largest on the 1982 cycle beginning with the 1974 return. The 1982 escapement was 129,000 sockeye of which 120,000 were adults, slightly more than obtained in 1974 and the largest number on record. Escapement to Weaver Creek was also the largest on record reflecting the exceptional return. It was not possible to adequately harvest the Weaver fish separate from Adams sockeye, a major disappointment. The total escapement of 295,000 fish was beyond the capacity of the stream and spawning channel. Nearly 58,000 adult sockeye were accommodated in the channel, the largest number allowed to spawn in this facility. While the escapement was larger than desired, some 659,000 Weaver sockeye were taken in the commercial fishery, more than the total number caught in the 11 years prior to the construction of the spawning channel. On the basis of racial analysis of late run sockeye delaying in the Strait of Georgia and from subsequent test fishing catches in the Fraser River during upstream migration of these races, it was known that the escapement to Weaver Creek would be excessive. At meetings held between Commission staff and Advisory Committee Members, it was concluded that an attempt should be made to harvest surplus Weaver Creek sockeye in the Harrison River where they would be separate from other sockeye runs. Weaver Creek sockeye were taken in the Harrison River at the entrance to Morris Slough and at the mouth of the Harrison River. The canned product was subsequently deemed by industry as less than desirable for a large scale venture even though much of the product graded favorably. A lack of interest in purchase of the surplus fish was associated with an already fairly large catch of sockeye in 1982 and previous marketing problems.

The Pitt River sockeye escapement was only 8,700 fish, the lowest since 1970 and the fourth smallest on record. Late run sockeye stocks in the Harrison River and Cultus Lake had satisfactory escapements. Harrison spawners totaled 9,200 fish primarily 4-year-old spawners produced by an escapement of 19,700 fish in 1978. Cultus Lake sockeye increased from 7,300 fish in 1978 to 17,200 spawners in 1982.

The total escapement of 4,024,000 spawners gives the potential for a good return in 1986. Success of spawning was excellent in most areas with the exception of Early Stuart, Gates Creek and Weaver Creek.

An estimated 230,000 visitors toured the Adams River area this year during the Salute to the Sockeye program. Weaver Creek channel also attracted a large number of

people to view the spawning.

The Indian fishery catch in the Fraser River and its tributaries was 401,000 sockeye, a record catch for the cycle (Appendix Table VI). This catch represented 2.9% of the Fraser sockeye run and 9.0% of the gross escapement. In 1978, the Indian catch amounted to 235,000 sockeye which was 2.6% of the total Fraser run and 8.6% of the gross escapement.

In 1982, echo sounding was again conducted at Mission between July 19 and October 4 to estimate the adult sockeye escapement migrating up the Fraser River. The acoustic estimate for midsummer sockeye totaled 834,000 fish which was in close agreement to the 837,600 gross escapement estimate obtained from the spawning grounds and Indian fishery catches. For late run sockeye, echo sounding gave an accumulated total of 3,340,000 sockeye which was 5% lower than the 3,522,000 fish accounted in catch and escapement. Both estimates had the least difference between estimated and accounted total experienced to date.

Visual counting of migrating sockeye and pink salmon has been carried out at Hell's Gate for a number of years. These counts have been an index of the escapement past Hell's Gate but are not complete counts. During the upstream passage of Adams-Lower Shuswap sockeye in late September-early October, 1982, experimentation with a Doppler-based riverine sonar system was conducted by contract studies for the Commission. The objective was to determine the feasibility of estimating fish passage in the turbulent environment present at Hell's Gate. Biomass estimates and fish counts from the sonar system were highly correlated. However, lack of background reverberation level estimates prevented determination of fish passage. Confirmation of heavy night migration was an important finding not available from previous visual observations.

SPAWNING CHANNEL OPERATIONS

Sockeye and pink salmon fry emergence from spawning channels in the spring of 1982 is presented in Table 4.

TABLE 4. Sockeye and pink salmon fry production from the 1981 brood at spawning and incubation channels.

Site	Species	Eggs Deposited	Fry Produced	Percent Survival
Upper Pitt	Sockeye	4,618,000*	3,818,000	82.7
Weaver Creek	Sockeye	41,563,000	21,615,000	52.0
Gates Creek	Sockeye	5,927,000	4,028,000	68.0
Nadina River	Sockeye	30,688,000	16,504,000	53.8
Upper Seton	Pink	11,006,000	3,877,000	35.2
Lower Seton	Pink	36,109,000	19,640,000	54.4

* eggs taken

The Upper Pitt incubation channel fry output of 3,818,000 fish was above the average (3,023,000) for all years (1963-1980). The percentage survival of 82.7% was slightly higher than the long term average of 80.0%.

Weaver Creek channel fry production from 1981 brood spawning was 21,615,000 sockeye which was 52.0% of the eggs deposited. A severe flood at Weaver Creek in 1977

deposited large amounts of silt in the channel and led to a record low survival (25.1%) of eggs in the channel that year. Prior to 1977, the egg to fry survival rate for the channel (1965-1976) averaged 74.3% at an average female spawner density of 6,425 fish. In 1978 the channel was cleaned and survival for 1978-1980 brood years has averaged 55.2%. However, at the same time the average number of effective females spawning in the channel increased almost three-fold to 17,286 fish during this three year period. From 1965 to 1976 fry production averaged 19,712,000 fish each year compared with 40,085,000 fry each year during the period 1978-1980. While it is apparent that cleaning of the gravel in 1978 did not fully restore the channel to pre-flood efficiency, the reduction in survival rate is not considered a serious problem because sufficient spawners are now available to increase spawning densities in the channel in order to yield fry populations that are considered optimum.

Gates Creek channel fry production of 4,028,000 fish in 1982 was more than double the previous cycle year total. The survival rate of eggs to fry was 68.0%, close to the average obtained in the previous 13 years of operation (69.4%). Fry production on the three non-dominant years has increased significantly each cycle and valuable adult sockeye contributions to the fisheries are obtained for these years. Although fry and adult production from this facility is increasing, the full potential of the channel has not yet been achieved.

Nadina River channel production of 16,504,000 sockeye fry in 1982 was 16.1% higher than in the previous cycle and the second largest in nine years of operation. The egg to fry survival rate of 53.8% was about 3% higher than for the 1977 brood. The 1979 to 1981 brood year survivals have averaged 46.7% compared with 66.9% from 1973 to 1978. Density of spawners in recent years (1979 and 1981) has increased significantly which may have contributed to some extent to lower survival, however, survival has dropped below 50% at female densities below the design capacity which suggests a problem at the channel not related specifically to density of spawners. The lower survival rates are of concern and studies of possible factors involved will be conducted.

Pink salmon fry production at the two channels at Seton Creek was similar to 1980. The lower Seton channel fry production of 19,640,000 fish was the second largest in eight cycles of operation and percentage survival from egg to fry of 54.4% was similar to the average of previous years (1967-1979) of 57.4%. Annual average fry production from 1967-1979 has been 15,143,000 fry. The upper channel produced 3,877,000 fry compared with the long-term (1961-1979) annual average of 4,558,000 fry. Percent survival from egg to fry was low 35.2%, compared with the average survival of 53.5% for the previously mentioned time period. Lower survival than that experienced in 1981 occurred in 1963 and 1965 with 21.7% and 34.5% survival in the respective years.

Returns of adult sockeye to the four channels in 1982 reached 940,000 fish, approximately double the previous maximum return. The major return was that of age 4 fish to Weaver channel (Figure 5). Approximately 960,000 Weaver sockeye returned in 1982 of which 910,000 fish of all age groups, were attributable to the spawning channel. The previous maximum adult production from this facility was 353,000 sockeye in 1974. A catch of 627,000 fish was taken in the commercial fishery yielding over $5,200,000 to fishermen.

The return of Pitt River sockeye at 17,000 fish was the smallest since 1952 (Figure 6). Only 5,300 fish were attributable to the incubation facility, the lowest number in all the years of operation. Total estimated fry entering Pitt Lake has increased in recent years by about double the number estimated for earlier years (1965-1974 average = 5,800,000; 1975-1980 average = 11,600,000). It is possible that the carrying capacity of the lake to support consistent large fry populations has been reached and further increased fry production under present lake conditions is not warranted. The 1977 brood

return (4-year-olds in 1981 and 5-year-olds in 1982) of only 30,000 adult sockeye was the lowest survival of fry to adult (0.28%) since at least brood year 1963. Gates Creek channel, showed a much improved cycle return of 6,000 sockeye, primarily 5-year-old fish from the 1977 brood spawning. Sockeye production from Nadina channel increased to 18,000 fish in 1982 from about 7,000 in 1978.

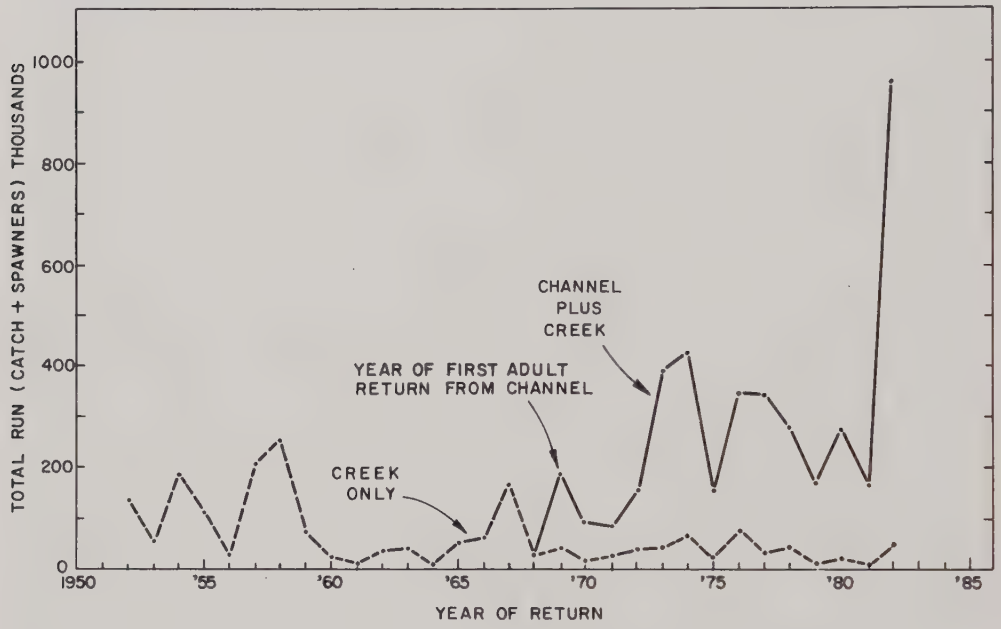

FIGURE 5. Sockeye production from Weaver Creek and Weaver channel, 1952-1982.

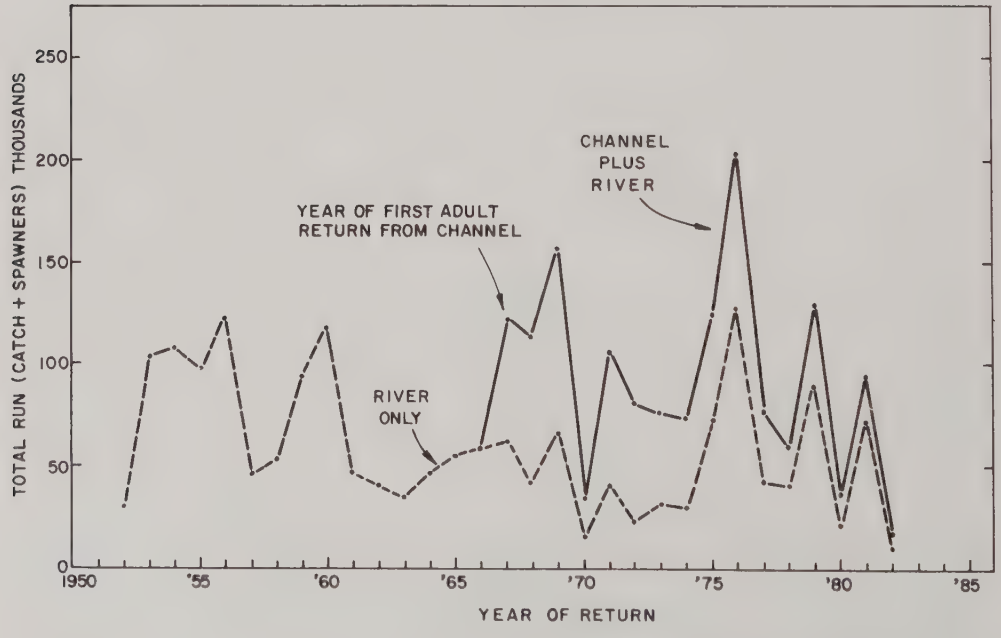

FIGURE 6. Sockeye production from Pitt River and Pitt River incubation channel, 1952-1982.

In the fall of 1982, a total of 2,657,000 eggs were taken from Upper Pitt River sockeye for the incubation channel. At Weaver Creek, 295,000 sockeye arrived at the spawning grounds because of the large run and the overlap in timing with the Adams River sockeye which did not allow selective harvest of Weaver sockeye. In an attempt to utilize the channel to a maximum, 58,000 spawners were allowed to enter the facility with a divider provided to reduce congestion in the upper section of the channel. The total was 39% larger than the previous maximum obtained in 1980. Escapement of spawners into Gates channel was 2,000 fish, a 21% increase from the previous cycle and adult female abundance was increased five-fold. Spawners were confined to the lower half of the channel to avoid the silted area at the upper end of the channel. Nadina channel spawners totaled 2,200 fish, 16% lower than in 1978.

RESEARCH

Research continued to be directed toward determining optimum fingerling carrying capacities of the major sockeye lakes in the Fraser River system. A series of surveys designed to collect information on sockeye distribution, growth, feeding behavior, food abundance and environmental conditions was carried out during the growing season in Quesnel Lake on the dominant year fry population.

Acoustic surveys completed in the latter part of June indicated high concentrations of fry in the Main Arm of Quesnel Lake with considerable shore orientation still present. Smaller concentrations of fry were present in the North Arm of the lake. Sockeye appeared to be concentrated at 10 m. Subsequent surveys carried out in mid-August and mid-October indicated that the population moved from a depth of 12 m in August to 40 m in October with most of the fish in the North and Main Arms of the lake and relatively few in the East Arm. Data processing of distribution, growth, feeding behavior and production of sockeye fingerlings and environmental conditions for Quesnel Lake continued in 1982.

Plans for increased logging activity in the Quesnel Lake watershed resulted in studies by the Commission in the spring of 1982 directed at determining the importance of the littoral zone of Quesnel Lake by sockeye fry from the Horsefly and Mitchell River populations. The littoral and limnetic fry migrations were documented using both visual and acoustic observations. Sockeye fry began showing in Quesnel Lake in significant numbers during the week of May 19-25. During the next 30 days sockeye used the littoral areas of Quesnel Lake for migration and feeding, and by June 21, sockeye migrations in the littoral zone were no longer observed. Visual observations at this time indicated fry were moving into mid lake areas (limnetic zone). Data on feeding behavior of sockeye and environmental conditions during initial lake rearing is being processed.

Information was collected on abundance, growth, distribution, food availability and environmental conditions in several other lakes on the watershed such as Takla, Trembleur, Stuart, Fraser, Shuswap, Harrison, Pitt and Cultus Lakes. Data analysis from these surveys will continue through 1983. The enumeration data from these lake surveys is used not only to provide information necessary for assessing management policies but is used also as one of many sources of data for forecasting adult returns.

A joint program using electrophoretic techniques to determine if there were detectable genetic differences between sockeye populations from both within and between lake systems in the Fraser River system as well as for comparison with other coastal sockeye stocks was initiated in 1982. This investigation was done in cooperation with scientists from the National Marine Fisheries Service in Seattle. Eye muscle, heart and

liver tissues from spawned sockeye were collected from six populations throughout the watershed. Samples from Early Stuart, Chilko, Birkenhead, Weaver, Adams and Lower Shuswap populations were frozen and sent to National Marine Fisheries Service, Seattle, for analysis. If differences are found, this would assist present racial methods.

Scientists from Fisheries Research Branch, Pacific Biological Station are investigating the feasibility of using parasites as a means of identification of freshwater origin of juvenile and adult sockeye salmon within Georgia and Johnstone Straits. Commission staff have been involved in program discussions and supplied sockeye fingerling samples from several Fraser River sockeye rearing lakes.

The poor escapement of Early Stuart sockeye to the spawning grounds in 1982 was a severe setback to the restoration of the run on this cycle. Examination of data obtained from visual observations and environmental records indicate that the Early Stuart population was confronted with adverse environmental conditions which could have stressed the sockeye.

A total of 71 dead Early Stuart sockeye were either recovered or spotted in the Stuart and Nechako Rivers in 1982. Many of these had evidence of severe gill erosion typical of *Flexibacter columnaris.* This is a significant number when compared to one dead fish recovered in 1978 and five dead recovered in 1979. Obviously, there was a problem occurring in the Stuart-Nechako system, however, it is difficult if not impossible to quantify the absolute magnitude of the loss at this particular location but based on the observations of dead fish and data from other years, it is concluded that a significant mortality of Early Stuart sockeye occurred en route to the spawning grounds. For those fish reaching the spawning grounds, success of spawning was 82.3% and many fish showed evidence of columnaris infection ranging from slight to severe.

The combination of high discharge, relatively high water temperatures and high turbidity for a short period could have stressed the sockeye, inviting the invasion of pathogens such as *Flexibacter columnaris* which in turn can kill sockeye. The events of 1982 underscore the fact that further research must be undertaken to understand the potential impacts of large projects such as Kemano on the sockeye and pink salmon production. Detailed examination of available data related to the loss of Early Stuart sockeye is being conducted.

In 1982, as in other recent years, oceanic sea surface temperature in the preceding winter or spring was the major factor used in predicting the run timing of the major stocks of Fraser River sockeye. The 1982 preseason predictions of run timing for the early and late sockeye stocks were close to the observed values, e.g. the Early Stuart returned about 2 days later, and the Adams/Lower Shuswap returned about two days earlier, than predicted. However, the prediction for the midsummer Chilko River stock was not as accurate, and this stock returned to Juan de Fuca Strait, about 6 days later than predicted. These inter-stock differences in run timing are still, in some cases, extremely difficult to predict.

The percentage of Fraser River sockeye returning via Johnstone Strait in 1982 was about 22% overall; with the midsummer stocks at 10 to 15% and the numerically dominant Adams River stock at 25 to 30%. The percentage migration via the northern route was less than half that observed in 1980 and 1981. The same factors as in 1981 were used in the preseason prediction for 1982, i.e. winter sea surface coastal transport and early summer coastal sea surface temperatures. The 1982 prediction was for an overall Johnstone Strait percentage migration of 16 to 20% with a possibility that the late stocks could return at up to about 30% via the northern route.

That the predictions for 1982 proved satisfactory leaves unaltered our inadequate understanding of the underlying causes of these variations in migration. More study of the weekly variation in sockeye migration routes has still not enabled us to indicate any factors which account for much of the short-term variation in a consistent manner.

ENVIRONMENT CONSERVATION

Quesnel River Pulp Company commenced operation of a thermo-mechanical pulp mill (TMP) at Quesnel in late 1981 using a mechanical clarifier and aerated lagoon to treat effluent before discharge to the Fraser River. Full scale operations at other pulp mills and tests of groundwood effluent in the Commission's laboratory prior to construction of the mill at Quesnel indicated detoxification was feasible using an aerated lagoon. The B.C. Waste Management Branch (WMB) discharge permit specified that at least 50 percent of fish must survive a 96 hour bioassay of undiluted effluent. However, monitoring by Canadian Environmental Protection Service and the B.C. Waste Management Branch showed effluent failed to meet discharge permit criteria for detoxification, except in May and June and periodically thereafter. Low effluent temperatures during mill start-up in winter 1981-82 were believed a cause of substandard detoxification during that period. The causes of later episodes of substandard detoxification were not defined precisely but appeared in part to be related to high organic loads and insufficient dissolved oxygen. Organic loads increaed substantially when the mill conducted trials of chemical thermal mechanical pulping (CTMP) in place of the conventional TMP upon which the treatment design was based.

To improve treatment, biological sludge which had accumulated in the stilling zones was removed and modifications were made to increase aeration capacity. However, since the company planned to increase CTMP pulping and thus the pollution load for treatment, it was recommended that the company conduct treatability tests to define modifications to the treatment scheme required to obtain consistent detoxification. The Commission plans to conduct laboratory tests in 1983 to examine treatment of TMP and CTMP from Quesnel.

Detoxification at Cariboo Pulp and Paper has been inconsistent over the past several years. Modifications in the pulp mill helped control some of the load to the treatment system but these did not completely solve the problems. Studies in 1982 revealed that flow through the secondary pond was not uniform resulting in shortened treatment time for some effluent. To correct this condition baffles were added to the aeration pond in late 1982.

The Weyerhaeuser kraft pulp mill at Kamloops discharges detoxified but highly colored effluent to the Thompson River. The company determined during tests in winter 1981 that color could be reduced by discharging effluent to an infiltration bed constructed on a sandbar in the Thompson River. The company applied for authorization to conduct a larger test in winter 1982-83. If successful, the infiltration beds would be expanded to about 100 acres of sandbar during the winter low flow period. According to the proposal, high water each spring would yield a fresh surface for infiltration the following winter. The Commission, Department of Fisheries and Oceans and the Environmental Protection Service proposed a testing program to determine whether there would be adverse effects on fish by the disposal method.

Northwood Pulp and Timber Company doubled their kraft pulping and bleaching capacity at Prince George with expansion of the original mill. A second aerated treatment lagoon was also completed to give a treatment time of eight days with the expanded mill operating.

Scott Paper Company Ltd. operates a combination groundwood pulp mill and paper mill at New Westminster. The company is expanding the paper mill and proposed to double the amount of effluent discharged to the North Arm of the Fraser River. Effluent is currently treated to reduce suspended solids and monitoring tests indicate it is not lethal to salmon. The expanded mill would use the same treatment methods with modifications to improve suspended solids removal. The Commission, Department of

Fisheries and Oceans and Environmental Protection Service reviewed the proposal and made recommendations to assure salmon are protected.

Commission staff continued a cooperative study with the Chemistry Department, University of British Columbia, to identify the metabolic processes by which resin acids in pulp mill wastes are detoxified by selected microorganisms. The study was expanded to include metabolites formed when monochloro- and dichloro- dehydroabietic resin acids were metabolised by the fungus *Mortierella isabellina.* Bioassays of metabolites demonstrated that initial metabolic processes reduced substantially the acute toxicity of chlorinated dehydroabietic acid to Daphnia pulex.

The proposal by B.C. Hydro to construct a coal-fired electric generating station at Hat Creek prompted a cooperative water sampling program by the Commission and the Department of Fisheries and Oceans to determine whether salmon-supporting water bodies downwind of Hat Creek may be sensitive to acid deposition. The survey demonstrated that some salmon-bearing waters would be sensitive to acid deposition. When the Hat Creek project was postponed, the water sampling program was revised to document sensitivity over a much wider area. It is now apparent that there are many salmon supporting streams which would be sensitive to acid deposition and these require protection.

Water sampling continued in the Nadina River basin to monitor the effects of logging and road building on suspended sediment. Suspended sediment peaked during spring freshet and remained at normal values during the remainder of the year. Water sampling was extended to Tachie River basin to obtain baseline data where a comprehensive logging program is being developed. The Department of Fisheries and Oceans officers collected samples during inspection trips to Tachie River in August, September and October.

A new sewage treatment plant was installed at Hemlock Valley ski area in late 1981 and was operational throughout 1982. Effluent from the treatment plant is pumped out of the Sakwi drainage to Maisal Creek which is tributary to Chehalis River. Silt laden runoff from clay banks along the road to the Hemlock Valley ski area remained as the major source of sediment to Sakwi Creek. To improve drainage, the Department of Highways installed additional culverts and upgraded ditches.

Iona Island sewage treatment plant discharges settled, chlorinated sewage to an outfall on Sturgeon Bank. As a consequence of judgments in Provincial Court in 1981, a Study Group composed of federal, provincial and Greater Vancouver Sewerage and Drainage District representatives produced a report early in the year with the following recommendations.

1) Improve primary treatment to treat all flows and provide dechlorination.
2) Implement source control to reduce toxicants discharged to sewer system and to designate safe disposal of tanker truck and hazardous wastes.
3) Design a deep sea outfall diffuser and conduct a minimum one-year pre-construction environmental impact study.
4) Install and monitor a deep sea outfall assuming a favorable design and environmental impact study.
5) Implement further control measures if monitoring shows unacceptable environmental effects.

Subsequently the Waste Management Branch issued a conditional permit for the existing discharge and specified "Development of alternative discharge strategies adequate to protect the receiving environment". The conditional permit, however, did not specify dechlorination. In autumn the GVSDD let a contract to consultants to conduct

environmental, oceanographic, sediment and engineering studies associated with a deep outfall off Sturgeon Bank at depths of 200 feet or more. The consultants report is due in September, 1983.

Three primary sedimentation tanks were added at Iona Island to make a total of 13 as specified in the conditional permit. A holding tank was added to receive septic tank haulage which allows addition of strong septic wastes to the main flow of sewage entering the plant at a controlled rate. Previously, septic wastes were added as slug loads which compromised the treatment process. However, the permit prohibited disposal of certain types of trucked bulk liquid or solid wastes by discharge to the treatment plant.

The GVSDD drafted a Source Control by-law under the new provincial Waste Management Act. This by-law would restrict or prohibit hazardous wastes or substances from being discharged to the municipal sewer system. The GVSDD is working with Vancouver and Burnaby to prepare an inventory of industrial discharges as a step in creating a Source Control program.

Municipal sewage is commonly disinfected with chlorine as a public health protection measure. Since chlorine is highly toxic to aquatic life, including sockeye and pink salmon, the Commission has recommended removal of chlorine residuals by dechlorination before municipal effluents are discharged to receiving waters. Although several discharges on the Fraser River system are dechlorinated, many have yet to be. During the year, dechlorination became operational at the Harrison Hot Springs sewage treatment plant and the city of Prince George was directed by the B.C. Waste Management Branch to dechlorinate municipal sewage. In addition, the discharge permit for a trailer park near Stave River specified that treated effluent be dechlorinated before discharge to the Fraser River.

In early April, 1982, Carolin Mines Ltd., near Hope, B.C., discharged supernatant from their tailings pond to Ladner Creek, a tributary of Coquihalla River. The discharge was made to prevent contaminated water in the tailings pond from rising to a level which would endanger the partially completed dam forming the tailings pond. The recycle and waste treatment systems were not operational. Dead fish were observed in Coquihalla River near the mouth of Ladner Creek on April 7 and subsequent measurements revealed cyanide in Ladner Creek and Coquihalla River. The mill shut down April 8 and action was taken to divert snowmelt from the tailings pond and to treat supernatant to destroy cyanides. Pink salmon spawn in the lower Coquihalla River about 15 miles downstream of the mouth of Ladner Creek and 24,000 spawners were reported in autumn, 1981. In April, 1982, pink fry would have developed to the emergent fry stage and some would have already migrated to the Strait of Georgia. To check for possible harm to pink salmon from the discharge at Carolin Mines, Commission staff sampled spawning redds on April 15, observing live pink and chum fry but no dead or distressed fish. All fry appeared normal.

Controlled discharges of treated effluent from Carolin Mines to Ladner Creek were subsequently authorized by the B.C. Waste Management Branch during the spring and summer to control tailings pond levels. Further work was done to raise the tailings dam and a temporary permit was granted by the Waste Management Branch authorizing discharge of treated non-lethal effluent through December 31, 1982. As the year ended, conditions proposed by Waste Management Branch for a revised discharge permit were under review by the Commission, Department of Fisheries and Oceans and Environmental Protection Service.

On March 3, 1982 a train carrying chemicals in tank cars derailed along the North Thompson River near Blue River. Although some of the chemicals were recovered, about 138,500 gallons of ethylene dichloride and 49,100 gallons of ethylene glycol were

lost to the North Thompson. Federal and provincial regulatory agencies documented the concentrations of ethylene dichloride downstream to the outlet of Kamloops Lake. The peak concentrations of ethylene dichloride reported occurred about 30 miles downstream of the wreck but dropped off sharply downstream of this location when sampled on successive days. Sockeye spawning occurs in the North Thompson downstream of Clearwater; 60 miles downstream of the wreck site. Department of Fisheries and Oceans personnel inspected salmon spawning redds just downstream of Clearwater and there was no evidence of effect on salmon eggs or alevins.

Concentrations of ethylene dichloride reported near Clearwater were well below the value of 260 mg/1 which caused sockeye alevins to lose equilibrium during 96 hour static bioassays at 3 degrees Celcius at the Commission's Sweltzer Creek laboratory. Alevins regained equilibrium when test solutions were replaced with fresh water. Ethylene glycol has a relatively low toxicity to salmonids and thus was not believed to pose a hazard.

Patches of Eurasian water milfoil *(Myriophyllum spicatum)* totaling 15 acres (6 ha) were discovered in 1981 in the Salmon Arm area of Shuswap Lake by the B.C. Aquatic Studies Branch. Growths of milfoil were removed by diver-dredging or were covered with bottom barriers. Surveys in 1982 by the Aquatic Studies Branch showed that Eurasian water milfoil remained in the Salmon Arm area but the populations had been suppressed by high and turbid water. The Aquatic Studies Branch concluded from a study of Shuswap Lake that the large annual water level fluctuations which occur normally limit the potential depth range of Eurasian water milfoil growth. The large numbers of spawning sockeye in the Shuswap district in 1982 were unaffected by Eurasian water milfoil.

At Cultus Lake, Eurasian water milfoil was controlled in recreational areas by rotovation or bottom barriers in 1982. Lindell Beach, where sockeye spawn in Cultus Lake, was cleared of Eurasian water milfoil by diver-dredging in 1979 and 1981. Surveys by the B.C. Water Management Branch and Commission staff in 1982 found Eurasian water milfoil ranged from sparse to dense at Lindell Beach. Observations by Commission staff indicated sockeye were not spawning among Eurasian water milfoil plants. To assure spawning grounds are unobstructed for the dominant sockeye run in 1983, the Commission recommended that Lindell Beach be treated by rotovation during summer, 1983.

To establish a uniform basis for comparing toxicity of wastewaters, the B.C. Pollution Control Board recommended that the WMB publish guidelines and laboratory procedures for bioassays using fish. A task force, including a representative from the Commission staff, was formed in 1981 to develop guidelines and standard procedures for measuring the acute lethal toxicity of liquid effluents to fish and to specify effluent handling and sampling procedures. In addition to the foregoing, the task force drafted preliminary guidelines relating type of sample (grab, composite) and bioassay mode (static, flow through) to stability and variability of the effluent. However, after review the task force concluded that to develop acceptable guidelines relating the foregoing variables, an unacceptable delay would occur and therefore these relationships were not included in the final report. The task force completed its report in 1982 and publication was expected in early 1983.

ENGINEERING

The Engineering Division's activities in 1982 included routine maintenance of the Commission's 13 fishways and 6 spawning and incubation channels, investigation of problems associated with existing and proposed hydroelectric projects and investigation

of possible effects of other multiple use developments that could threaten the productivity of Fraser River sockeye and pink salmon.

Flooding due to removal of natural forest cover in the headwaters of the Weaver Creek spawning channel causes extensive erosion and sediment deposition in Weaver Creek. Each year since 1977, when a major flood occurred, it has been necessary to excavate sand and gravel from Weaver Creek to provide an adequate flood channel and to maintain the water intakes, barrier fence and fish diversion facilities.

Minor maintenance work was done at the other spawning and incubation channels. At the Pitt River incubation facility, gravel cleaning is required every year since the water supply is sometimes heavily silted, overloading the settling basins. The gravel is usually cleaned by hand digging and simultaneous washing with a hand-held high-pressure jet. This process was mechanized in 1982 by using a newly developed mobile air-water jet cleaner similar to the larger model used in the Commission's spawning channels.

The gravel was heavily silted at the upper end of the Gates Creek spawning channel but cleaning was not necessary since the expected small spawning population could be accommodated in the lower part of the channel, which contained much less silt. The Nadina channel draws relatively clean water from Nadina Lake and therefore seldom needs cleaning. The Weaver Creek spawning channel was not cleaned in 1982. The last cleaning was done in 1978, following the devastation caused by the November 1977 flood. Cleaning has not been necessary in recent years because, despite significant silt deposition in the channel, the large numbers of returning spawners have been considered sufficient to produce enough fry to meet the apparent rearing capacity of the lake.

Maintenance of the Hell's Gate, Bridge River Rapids and Yale fishways will require increasing maintenance in future years since these steel and concrete structures were built 16-38 years ago and there is obvious deterioration with age in the environment in which these structures must operate. In addition to removing debris from the fishways and repairing steel gratings damaged by logs and rocks, it has become necessary to fasten abrasion-resistant steel plate to the Hell's Gate fishways in certain areas where the concrete has shown excessive wear due to the effects of bedload. Also, in 1982, the access road from the public highway to Hell's Gate was upgraded by building a short section of new road through a rock outcrop to eliminate a badly deteriorated timber trestle.

Investigations related to habitat protection include cooperating with the Department of Fisheries and Oceans in recommending habitat protection measures for dredging of the Fraser River navigation channel, dock building, water intakes, placer mining, bridge construction, pipeline crossings and other proposals affecting the migration routes, spawning areas and juvenile rearing areas. The Commission has cooperated with B.C. Hydro and its consultants in designing fish protection requirements for a proposed large water intake on Thompson River for the Hat Creek coal-fired power generating station. Hydraulic models built by the consultants were used for studying proposed design of fish screens for bypassing juvenile migrants and the effects of various construction techniques on upstream migration of adult salmon. B.C. Hydro has now announced that construction of this project has been postponed indefinitely.

Commission personnel participate in a joint industry-government committee attempting to reduce the impact of logging and road building in the important Nadina River watershed. Water samples are systematically taken from Nadina River and its tributaries to provide a basis for monitoring and controlling erosion caused by the present logging and road building activities. Recommendations were also made to the Department of Fisheries and Oceans concerning proposed logging activities in the Stuart and Quesnel River watersheds, which are important sockeye producing areas, and on

the islands in the lower Fraser, adjacent to a major pink salmon spawning area.

Funds have been provided by B.C. Hydro since 1977 for experiments and observations at the Seton Creek hydroelectric plant to study effects of this development on productivity of sockeye and pink salmon. The 1982 studies confirmed that the problem of loss and injury of adult sockeye in the tailrace can be overcome by limiting the proportion of Cayoosh Creek water in Seton Creek. B.C. Hydro has taken steps to reduce the discharge of Cayoosh Creek water into Seton Creek. Investigations also showed that sockeye smolts are delayed in Seton Lake due to sporadic plant operation and that about 98% of these seaward migrants pass through the turbine, where previous tests showed that 10% mortality occurred. There are some indications that the mortality rate has increased in recent years. Maximum production of Portage Creek and Gates Creek sockeye cannot be realized until the artificial delay of juveniles in Seton Lake is overcome and mortality of downstream migrants in the turbine is eliminated.

The Aluminum Company of Canada has, since 1978, been investigating the potential environmental effect of increasing the amount of hydroelectric power developed at Kemano. One of the consequences of this increase in power production would be reduced discharges in Nechako River between Cheslatta River and Prince George. The existing Nechako-Kemano diversion has already reduced the discharge of the upper Nechako River to about one half the natural flow. Further flow reduction would cause significant environmental changes that could affect salmon production in many ways. The most significant effect would probably be caused by increased temperatures in Nechako River. Other potential impacts of the proposal include reduced dilution of pollutants, temperature increase in the Fraser River, obstruction of adults due to low Nechako and Fraser River water levels and numerous secondary effects such as increasing the need for navigation dredging in the mainstem pink salmon spawning area between Hope and Sumas. These and several other potentially serious effects of Nechako River flow reduction were brought to Alcan's attention in monthly meetings of the Alcan Joint Technical Committee on which the Commission is represented along with the Department of Fisheries and Oceans as well as other agencies. This Committee was formed in 1981 to promote the exchange of information regarding requirements for protection of the fishery resources affected by the existing Nechako-Kemano diversion project and those that would be affected by Alcan's proposed expansion program, which involves diversion of Nanika River as well as the diversion of additional flow from the Nechako watershed. One important function of this Committee is to arrange for discharges from the reservoir for controlling Nechako River temperatures in order to reduce the adverse effect on upstream migrating adult sockeye of Alcan's existing hydroelectric development.

In 1982, for the third consecutive year, Alcan complied with the Order of the B.C. Supreme Court which requires the company to spill water from its reservoir for sockeye protection. In a joint field program with Alcan and the Department of Fisheries and Oceans, water temperatures were measured at eight locations in the Nechako system and these data were used along with weather forecasts provided by the Atmospheric Environment Service in an attempt to determine the amount of water to be spilled from the reservoir to reduce Nechako River water temperatures during the sockeye migration.

Alcan did not provide a cold-water spillway from the reservoir as requested by the Department of Fisheries and Oceans and the Salmon Commission when the project was approved by the Government of British Columbia 30 years ago. Therefore, the only way to prevent excessive warming of Nechako River is to increase river discharge by drawing water from the surface layers of the reservoir. The spillway is located 50 miles from the Nechako River and it takes several days before the spilled water reaches the section of Nechako River used by sockeye. Accurate weather forecasts are therefore essential for

calculating the amount of spill required for temperature control.

Weather forecasts in 1982 predicted much cooler weather than actually occurred during the migration period of the main part of the Early Stuart sockeye run. Consequently, not enough water was spilled from the reservoir and temperatures on the migration route reached levels that are known to cause sockeye to be stressed, which makes them more susceptible to disease. Nechako River temperatures exceeded 68° for six consecutive days immediately above Stuart River and for seven consecutive days at Prince George. The maximum temperature reached nearly 71°F. During this period, Nechako River temperatures increased by as much as 1° during the 1-day water travel time from the Stuart confluence to Prince George. Stuart River also reached critically high temperatures during this period, although it was up to 2.5° cooler than the Nechako. Early Stuart sockeye would have been exposed to critically high temperatures for at least four consecutive days in migration from Prince George to Fort St. James. Dead and moribund sockeye were found in the Nechako and Stuart Rivers from July 27 to August 7. The total escapement reaching the spawning grounds was only 4,560 fish indicating significant loss of sockeye during upstream migration. Although this loss may have been partly caused by difficult migration conditions in the Fraser River, including high water levels, high silt content and high temperatures, the high Nechako River temperatures are considered to have contributed to the mortality and may have been a major factor in the loss.

A proposed diversion of Taseko River for power generation on Homathko River was reviewed in 1982. However, B.C. Hydro has subsequently decided not to proceed with the Taseko River portion of the study at the present time.

Detailed examinations were conducted of the proposal by Canadian National Railway to twin-track the existing line through the Thompson and Fraser canyons. The Commission is represented on a Federal Task Force that is responsible for coordinating the assessment of resource impacts, such as reviewing the work of the railway's consultants, planning further studies and reviewing details of the railway's construction plans. The project could affect sockeye and pink salmon as a result of encroachments into the river channel for building the railway in some areas. These encroachments would increase river velocities, occupy fish rest areas and eliminate some of the existing and potential pink salmon spawning areas in Thompson River.

A biological study was undertaken in 1982 in conjunction with the Department of Fisheries and Oceans, the Canadian National Railway and the Provincial Ministry of Environment to obtain basic information related to the CN proposal. The purpose of this study was to determine the behavior of Adams River sockeye as they migrated through the Fraser and Thompson canyons.

Fish were captured at the lower ends of these canyons and a small radio transmitter was inserted orally. The fish were then tracked from an airplane and by foot using directional radio antennas to determine the speed of migration and points of difficult passage. It is planned that the study will be repeated in 1983 with pink salmon since little information is available on their migration behavior and swimming ability. Further studies are also required to assess effects of proposed encroachments on pink salmon spawning areas.

TABLE I

SOCKEYE CATCH BY GEAR

Gear		1970	1974	1978	1982
United States Convention Waters					
Purse Seines	Units	191	272	165	246
	Catch	779,271	1,515,444	694,460	1,686,609
	Percent	57.72	61.56	50.97	58.83
Gill Nets	Units	492	1,140	999	1,028
	Catch	504,873	873,595	635,795	1,124,475
	Percent	37.39	35.49	46.67	39.22
Reef Nets	Units	41	54	43	43
	Catch	65,644	72,408	31,832	55,280
	Percent	4.86	2.94	2.34	1.93
Troll	Catch	429	228	359	546
	Percent	0.03	0.01	0.03	0.02
TOTAL CATCH		1,350,217	2,461,675	1,362,446	2,866,910
Canadian Convention Waters					
Purse Seines	Units	87	202	46	201
	Catch	441,120	1,044,742	460,603	1,525,003
	Percent	28.61	41.79	34.97	46.57
Gill Nets	Units	1,263	1,000	1,199	784
	Catch	955,178	1,029,678	626,506	924,648
	Percent	61.95	41.19	47.57	28.24
Troll	Catch	145,473	425,599	230,006	824,826
	Percent	9.44	17.02	17.46	25.19
TOTAL CATCH		1,541,771	2,500,019	1,317,115	3,274,477

NOTE: Gear counts represent the maximum number of units delivering sockeye on a single day near the peak of the run.

TABLE II

CYCLIC LANDINGS OF SOCKEYE FROM CONVENTION WATERS

	United States	*Canada*	*Total*
1982			
Total Landings (No. Sockeye)	2,866,910	3,274,477	6,141,387
Share in Fish	46.68%	53.32%	
1946-1982			
Total Landings (No. Sockeye)	61,672,590	60,760,154	122,432,744
Share in Fish	50.37%	49.63%	
1982 Cycle Catch			
1982	2,866,910	3,274,477	6,141,387
1978	1,362,446	1,317,115	2,679,561
1974	2,461,675	2,500,019	4,961,694
1970	1,350,217	1,541,771	2,891,988
1966	1,337,215	1,350,154	2,687,369
1962	758,637	836,399	1,595,036
1958	5,257,316	5,241,617	10,498,933
1954	4,806,258	4,722,463	9,528,721
1950	1,220,893	894,469	2,115,362
1946	3,551,310	4,240,198	7,791,508
1942	2,935,192	5,047,599	7,982,791
1938	1,408,361	1,900,220	3,308,581
1934	3,590,058	1,430,300	5,020,358
1930	3,544,718	1,043,318	4,588,032
1926	469,900	912,566	1,382,466
1922	513,848	580,144	1,093,992
1918	569,094	242,275	811,369
1914	3,555,890	2,137,177	5,693,067
1910	2,765,726	1,690,091	4,455,817
1906	2,030,550	2,066,604	4,097,154
1902	4,001,717	3,177,538	7,179,255

TABLE III

DAILY CATCH OF SOCKEYE, 1970-1974-1978-1982 FROM UNITED STATES CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	**1970**	**1974**	**1978**	**1982**	**1970**	**1974**	**1978**	**1982**	**1970**	**1974**	**1978**	**1982**
1							57,144		31			27,859
2								79,584	6			28,753
3					79,718			265,218		55,431		3,715
4					43,413			121,659				
5					35,355							
6												918
7						234,490			549			1,680
8						142,942			301			107
9								116,129	671	12,421		
10					70,672			212,014	275	6,988		
11					55,718			83,053		5,044	36,666	
12					59,364	105,239		33,931			11,759	
13	4,133				67,530	139,059	33,751				5,670	
14	1,716				48,662	103,232	77,453	48,046	11,940			81
15		8,175				154,957	63,511		2,356			66
16		1,776	2,124		67,087		17,125	236,728	1,373	11,730		119
17			10,355		89,253			219,450	168	4,321		
18			8,379		94,580			79,117	1,722	1,450	22,278	
19					73,372			74,531			8,135	
20	14,399				52,020	310,026	16,556				3,014	
21	10,630					216,732	354,173	89,369	792			
22	14,252	4,661				158,644	184,516	31,716	258			27
23	9,783	3,997	6,245				163,430	405,796	2,634	1,442		
24			22,694				20,481	58,480	3,842	504		
25			15,825	52,671				15,007	802	262	2,030	
26				85,363		308,214					3,080	
27	47,077			31,622	234,354	238,166	48,944				5,341	58
28	33,591				91,263		138,993	17,987	1,305			72
29	11,710	100,429						302,497	1,094			206
30		75,587						59,073	923			44
31		55,127	13,705		49			83,299				
Totals	147,291	249,752	79,327	169,656	1,162,410	2,111,701	1,176,077	2,632,684	31,042	99,593	97,973	63,705
Troll	57	133	286	151	365	87	48	288	1	1		100
Monthly Totals	147,348	249,885	79,613	169,807	1,162,775	2,111,788	1,176,125	2,632,972	31,043	99,594	97,973	63,805
June, Oct. & Nov. Totals									9,051	408	8,735	326
Season Totals									1,350,217	2,461,675	1,362,446	2,866,910

TABLE IV

DAILY CATCH OF SOCKEYE, 1970-1974-1978-1982 FROM CANADIAN CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	**1970**	**1974**	**1978**	**1982**	**1970**	**1974**	**1978**	**1982**	**1970**	**1974**	**1978**	**1982**
1							47,145		933	13,378		10,393
2		14,984					39,809		167,484	9,823		
3					84,815			19,411		79,914		
4					133,926							
5						64,383					108,180	
6												1,445
7						194,503			107			27,433
8		29,177				180,367	71,632		5,627			
9		5,701						229.517	61	112,839		
10		9,000						173,281		1,271	32,682	
11					231,605			122,287	8,248			
12					185,031				105		23,715	
13	5,562								139	135,407		
14							87,122		239			
15		7,754	Strike			32,131						
16			July 16-19					461,425		1,405		
17			4,997		94,112			195,375		1,712		
18					103,304	147,866					3,633	
19						113,219						
20	9,883					199,353		36,103				
21	5,225						216,090					
22		4,838					122,905	451,434				
23		3,328					124,712	295,756				169,785
24			14,087									
25			6,736			34,766						
26				36,449		88,440						
27	71,450				27,577	33,882						78,764
28	45,779				4,850	235,993	83,743		150,254		64,897	
29	21,227	84,653										76,698
30		94,877								26,041		
31		103,943			1,975							
Totals	159,126	358,255	25,820	36,449	867,195	1,324,903	793,158	1,984,589	333,197	381,790	233,107	364,518
Troll	11,353	49,208	9,251	256,162	134,009	368,553	214,652	550,299	51	7,814	6,103	18,365
Spring Salmon Gill Nets	1,025		2,142		5,222							
Monthly Totals	171,504	407,463	37,213	292,611	1,006,426	1,693,456	1,007,810	2,534,888	333,248	389,604	239,210	382,883
June, Oct. & Nov. Totals									30,593	9,496	32,882	64,095
Season Totals									1,541,771	2,500,019	1,317,115	3,274,477

TABLE V

INDIAN CATCH OF SOCKEYE BY DISTRICT AND AREA, 1978 and 1982

	1978		1982	
District and Area	*Catch*	*No. of Fishermen**	*Catch*	*No. of Fishermen**
HARRISON-BIRKENHEAD				
Birkenhead River and Lillooet Lake	14,910	1	9,245	1
TOTALS	14,910	1	9,245	1
LOWER FRASER				
Below Hope	84,349	515	136,890	583
TOTALS	84,349	515	136,890	583
MIDDLE FRASER				
Hope to Lytton	70,755	495	145,496	692
Lytton to Churn Creek	24,015	555	23,875	510
TOTALS	94,770	1,050	169,371	1,202
CHILCOTIN				
Farwell Canyon to Siwash Bridge	6,889	108	14,950	201
Keighley Holes	1,561		—	
TOTALS	8,450	108	14,950	201
UPPER FRASER				
Churn Creek to Quesnel	4,588	176	20,465	177
Shelley	704	33	2,253	65
TOTALS	5,292	209	22,718	242
NECHAKO				
Nautley and Stella Reserves	6,236	94	13,227	99
TOTALS	6,236	94	13,227	99
STUART				
Fort St. James-Pinchi Village	3,293	51	1,491	49
Tachie, Takla & Trembleur Villages	3,836	79	1,661	126
TOTALS	7,129	130	3,152	175
THOMPSON				
Main Thompson	14,250	484	30,320	499
North Thompson	—	—	—	—
South Thompson	—	—	1,160	39
TOTALS	14,250	484	31,480	538
GRAND TOTALS	235,386	2,591	401,033	3,041

*Number of licences issued to Indians in district.

The Indian catch statistics detailed above are obtained from the Canada Department of Fisheries and Oceans. Their officers control the taking of sockeye by the Indian populations residing throughout the Fraser River watershed.

TABLE VI

SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1970, 1974, 1978, 1982

District and Streams	1982 Period of Peak Spawning	Estimated Number of Sockeye				Jacks	Sex Ratio	
							Males	Females
		1970*	1974*	1978	1982		4-5 Yr.	4-5 Yr.
LOWER FRASER								
Cultus Lake	Mid Nov.	15,149	9,814	7,265	17,222	497	6,445	10,280
Upper Pitt River	Sept. 11-15	6,657	20,792	24,835	8,725	17	3,599	5,109
Widgeon Slough	Nov. 4-8	364	1,643	1,600	515	6	218	291
HARRISON								
Big Silver Creek	Sept. 20-23	261	837	1,253	1,919	0	959	960
Harrison River	Nov. 7-11	12,675	16,920	19,747	9,189	0	4,492	4,697
Weaver Creek	Oct. 15-25	6,373	42,143	43,989	237,542	323	131,638	105,581
Weaver Channel	Oct. 12-27	4,723	24,664	32,248	57,932	137	26,812	30,983
LILLOOET								
Birkenhead River	Sept. 20-30	72,760	173,463	99,857	128,771	9,033	46,350	73,388
SETON-ANDERSON								
Gates Creek	Aug. 28-Sept. 3	68	146	931	232	131	45	56
Gates Channel	Aug. 28-Sept. 3	735	1,645	1,639	1,977	1,148	316	513
Portage Creek	Nov. 1-6	3,901	8,986	10,230	23,965	98	11,769	12,098
SOUTH THOMPSON								
Seymour River	Sept. 9-13	11,991	45,189	62,929	63,306	35	35,785	27,486
Eagle River	Sept. 12-15	23	263	189	1,642	0	798	844
Scotch Creek	Sept. 2-6	304	464	2,056	4,709	0	2,165	2,544
Anstey River	Sept. 2-6	196	666	886	776	9	434	333
Upper Adams River	Sept. 12-15	4	13	0	124	0	57	67
Lower Adams River	Oct. 19-30	1,297,990	889,613	1,493,473	2,070,813	834	990,420	1,079,559
Little River	Oct. 26-31	168,881	122,112	81,055	239,278	99	117,915	121,264
South Thompson River	Oct. 26-31	5,931	14,466	9,986	73,603	23	26,774	46,806
Lower Shuswap River	Oct. 15-25	29,074	86,396	187,167	513,925	28	250,256	263,641
Middle Shuswap River	Oct. 18-23	4,559	3,064	10,890	40,302	2	19,625	20,675
Misc. Late Runs	Oct. 17-Nov. 2	50,389	41,882	117,832	123,337	37	60,526	62,774
NORTH THOMPSON								
Raft River	Sept. 1-3	4,474	2,396	2,500	2,992	0	1,459	1,533
Fennell Creek	Aug. 29-Sept. 2	9	243	675	1,139	7	476	656
North Thompson River	—	270	343	—	—			
CHILCOTIN								
Chilko River	Sept. 18-23	145,049	128,131	151,835	242,263	2,360	99,437	140,466
Chilko Lake-South End	Early to Mid Sept.	0	14,464	7,339	11,288	1,613	3,112	6,563
QUESNEL								
Horsefly River	Sept. 6-12	1,350	4,459	7,287	30,317	0	14,839	15,478
Mitchell River	Sept. 16-20	23	—	1,237	3,829	0	1,874	1,955
NECHAKO								
Nadina River (Early)	—	78	0	0	0	0	0	0
(Late)	Sept. 19-22	3,939	2,930	227	194	0	75	119
Nadina Channel	Sept. 19-22	—	895	2,555	2,156	1	830	1,325
Stellako River	Sept. 25-30	45,876	41,473	60,421	69,434	14	30,946	38,474
STUART								
Early Runs								
Ankwill Creek	Aug. 7-9	220	544	1,363	46	0	20	26
Bivouac Creek	—	0	40	157	0	0	0	0
Crow Creek	Aug. 8-10	396	981	467	40	0	17	23
Driftwood River	Aug. 12-13	1,983	1,894	4,903	29	0	13	16
Dust Creek	Aug. 10-13	963	934	657	165	0	71	94
Felix Creek	Aug. 3-8	2,866	3,201	5,575	454	0	218	236
Fleming Creek	—	106	20	590	2	0	1	1
Forfar Creek	Aug. 5-11	6,476	5,495	9,579	676	0	280	396
Forsythe Creek	—	187	270	381	2	0	1	1
Frypan Creek	Aug. 7-9	130	362	448	40	0	17	23
Gluske Creek	Aug. 5-11	5,702	5,548	4,295	452	0	153	299
Kynoch Creek	Aug. 5-11	4,676	10,652	10,649	1,170	3	461	706
Leo Creek	—	41	32	34	0	0	0	0
Narrows Creek	Aug. 8-11	144	486	709	78	0	34	44
Paula Creek	Aug. 6-8	565	2,059	1,604	68	0	32	36
Rossette Creek	Aug. 5-10	7,664	5,675	7,452	1,300	0	600	700
Sakeniche River	—	0	51	123	0	0	0	0
Sandpoint Creek	Aug. 5	358	599	493	4	0	2	2
Shale Creek	Aug. 10-12	34	345	470	19	0	8	11
Misc. Streams	July 28-30	236	456	148	15	0	6	9
Early Stuart Totals	Aug. 3-13	(32,747)	(39,644)	(50,097)	(4,560)	(3)	(1,934)	(2,623)
Late Runs								
Kazchek Creek	Sept. 18-20	74	239	122	410	0	198	212
Kuzkwa Creek	Sept. 19-22	90	718	742	1,237	0	596	641
Middle River	Sept. 19-21	12,115	8,990	4,061	7,450	0	3,591	3,859
Pinchi Creek	Sept. 21-23	0	0	74	133	0	64	69
Tachie River	Sept. 20-25	2,776	4,680	8,028	7,528	0	3,628	3,900
Late Stuart Totals	Sept. 18-25	(15,055)	(14,627)	(13,027)	(16,758)	(0)	(8,077)	(8,681)
NORTHEAST								
Upper Bowron River	Sept. 1-5	1,341	1,850	3,150	1,647	0	657	990
TOTALS **		1,943,221	1,757,474	2,514,318	4,024,261	16,541	1,909,181	2,098,536

* Numbers for some populations are revised from the Annual Report for the respective years.
** Totals include small numbers of fish in small tributaries not listed in the table.

TABLE VII

DAILY CATCH OF SOCKEYE, 1967-1971-1975-1979 FROM UNITED STATES CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	1967	1971	1975	1979	1967	1971	1975	1979	1967	1971	1975	1979
1		1,068			83,010	9,704			17,852	79,685		
2					94,322	145,517				60,079	12,595	
3						94,802				87,853		2,009
4						53,159				56,222		38
5		12,708						162,300	11,025	1,411		
6		8,111			5,594			570,259	11,025	87,582		
7		9,281	72,530		88,268			231,876	6,254	69,145		
8		4,588	27,405		58,194	7,447				33,948	866	
9	251		20,843			155,896					683	
10	4,465					88,141						
11	3,762	1,714				58,076	194,558		2,548			
12		20,210				39,934	124,550		7,379			
13		17,672			152,217			39,498	4,728			
14		15,708	31,499		115,530	4,037	111,121	76,602	1,982	281	249	
15		9,213	12,561		104,995	109,435		33,180		4,431	152	
16	1,145			12,889	64,753	113,464				3,305	113	703
17	16,742			2,341		104,877				1,891		1,064
18	12,781	6,773		3,987		108,613	99,033		2,631			35
19		56,405				76,550	80,684	4,354	604	175		10
20		45,037				50,385	42,852	62,270	515	1,163		
21		37,835	103,060		189,061	547		66,914	198	980		
22			73,338	29,307	197,978	112,368		4,586		594		
23	5,072			166,862	156,371	93,858		32,736			139	
24	103,996			24,654	108,378	86,382		1,611			111	
25	74,382	16,459				55,063		1,195	11			
26	67,596	105,003				19,109	37,880	20,420	9	7		
27	54,405	72,329					18,493	13,936	6	396		
28		85,289	187,942					612		116		
29		89,638	122,179		41,810			7,179		64	18	
30	6,455		93,726	160,301	27,915	6,599		201		38	13	
31	146,028		91,233	40,500	31,254	94,802		89				
Totals	497,080	615,041	836,316	440,841	1,519,650	1,688,765	709,171	1,329,818	66,767	489,366	14,939	3,859
Troll	143	122	189	562	34	190	316	738	0	6	8	0
Monthly Totals	497,223	615,163	836,505	441,403	1,519,684	1,688,955	709,487	1,330,556	66,767	489,372	14,947	3,859
June, Oct. & Nov. Totals									4,152	22,639	2,912	58
Season Totals									2,087,826	2,816,129	1,563,851	1,775,876

TABLE VIII

DAILY CATCH OF SOCKEYE, 1967-1971-1975-1979 FROM CANADIAN CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	**1967**	**1971**	**1975**	**1979**	**1967**	**1971**	**1975**	**1979**	**1967**	**1971**	**1975**	**1979**
1		231			19,223	114,248				19,968	232	
2		Strike			16,577	189,823				34,675	28,563	
3		June 26-				113,015			2,170	124,765		
4		July 10					50,455		29,490	16,483		9,256
5		953					40,096	456,514	27,699	20,106	11,838	
6		915			73,831			178,519	476	50,720	597	
7		850	36,951		184,860				639		454	
8		874			89,770				441	40,196	40,283	
9			8,136	34,395	114,059	288,641				46,210		
10						188,407	6,174			36,579		
11		39,111				198,973	4,731		55,886	32,316		
12		16,037					11,665	106,815	37,370	27,253		
13							10,241	57,850	793	3,514		
14			30,328		183,161			47,713	318	18,537	7,177	
15		12,044			129,684					18,225	223	
16				10,485	104,460	190,798		87,925			131	
17	10,864					87,209					43	323
18	8,744						25,011		650		12,914	856
19	6,984	21,756					9,082		371			
20		13,361					8,015	96,442	208	391		
21			26,256		115,565		7,752	9,430		167		
22			17,519		76,188	60,261	3,278	2,863	50,985	16,238	6,173	
23				43,593	36,132	86,106		19,211		7,811	66	
24	47,625		Strike			16,933						
25	21,971		July 25-				40,306	8,000	234		3,254	
26	27,672	187,654	Aug. 24			142,151	18,025	5,021	115	22,579		
27	26,691	40,513				100,315	2,516	62,022	108	2,315		
28		18,266	25,123		66,008							
29			13,201		24,586					6,281	3,378	
30				156,952	5,799	173,063		1,498		2,812	13	
31	92,491				4,370	54,019						
Totals	243,042	352,565	157,514	245,425	1,244,273	2,003,962	237,347	1,139,823	207,953	548,141	115,339	10,435
Troll	32,565	21,857	2,145	55,795	125,490	166,518	41,800	160,891	3,470	2,460	6,337	218
Spring Salmon Gill Nets	1,142	617								4,786	3,571	
Monthly Totals	276,749	375,039	159,659	301,220	1,369,763	2,170,480	279,147	1,300,714	211,423	555,387	125,247	10,653
June, Oct. & Nov. Totals									17,547	13,392	80,420	7,678
Season Totals									1,875,482	3,114,298	644,473	1,620,265

TABLE IX

SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1967, 1971, 1975, 1979

District and Streams	*1979 Period of Peak Spawning*	*Estimated Number of Sockeye*			
		1967*	1971*	1975*	1979
LOWER FRASER					
Cultus Lake	Nov. 29-Dec. 5	33,492	9,145	11,478	32,045
Upper Pitt River	Sept. 14-16	10,300	15,469	39,942	37,558
Widgeon Slough	Oct. 31-Nov. 3	1,006	394	936	599
HARRISON					
Big Silver Creek	Sept. 21-23	0	0	31	119
Harrison River	Nov. 23-27	20,577	3,790	5,987	45,706
Weaver Creek	Oct. 27-Nov. 2	19,730	2,887	12,195	28,515
Weaver Channel	Oct. 28-31	2,887	2,736	19,816	22,888
LILLOOET					
Birkenhead River	Sept. 24-29	58,036	32,672	92,928	78,088
SETON-ANDERSON					
Gates Creek	Aug. 30-Sept. 2	1,665	797	788	907
Gates Channel	Aug. 29-Sept. 2	—	1,502	3,768	4,118
Portage Creek	Nov. 6-8	4,048	281	3,829	3,663
SOUTH THOMPSON					
Seymour River	Aug. 28-Sept. 5	13,361	19,028	37,024	49,321
Upper Adams River	—	—	0	23	0
Lower Adams River	Oct. 17-20	755,238	280,176	148,187	275,616
Little River	Oct. 20-25	74,490	2,821	7,268	10,443
South Thompson River	Oct. 20-25	270	40	16	144
Lower Shuswap River	Oct. 13-15	5,951	6,117	11,652	10,092
Misc. Late Runs	Oct. 17-Nov. 1	9,981	1,169	1,442	3,418
NORTH THOMPSON					
Raft River	Sept. 2-6	1,303	840	2,664	1,708
Barriere River	—	16	5	0	0
Fennell Creek	Aug. 26-31	920	1,300	4,127	15,590
North Thompson River	—	—	888	123	1,009
CHILCOTIN					
Chilko River	Sept. 16-20	176,337	161,943	220,554	240,294
Chilko Lake South End	Early Sept.	—	12,323	55,144	32,400
Taseko Lake	Aug. 29-Sept. 2	5,700	10,500	4,394	—
QUESNEL					
Horsefly River	Sept. 12-15	119	171	101	511
Upper McKinley River	—	—	—	100	0
NECHAKO					
Endako River	Sept. 6-8	949	284	192	1,294
Nadina River (Early)	Sept. 9-12	1,595	1,222	481	1,809
(Late)	Sept. 24-27	7,790	14,525	4,013	14,474
Nadina Channel (Late)	Sept. 22-27	—	—	11,306	41,212
Nithi River	Aug. 15-16	1,688	1,796	1,144	1,300
Ormonde Creek	—	0	0	0	0
Stellako River	Sept. 29-Oct. 3	91,525	39,726	176,079	290,116
STUART					
Early Runs					
Driftwood River	Aug. 6-8	52	335	20	247
Forfar Creek	July 31-Aug. 1	4,815	25,178	6,818	15,805
Gluske Creek	Aug. 2-3	1,368	14,305	10,370	10,040
Kynoch Creek	Aug. 1-2	6,694	22,932	25,124	34,228
Narrows Creek	Aug. 1-2	454	3,467	1,704	1,575
Rossette Creek	July 30-Aug. 1	6,566	16,445	8,543	15,893
Misc. Streams	Aug. 1-Sept. 4	1,120	13,271	13,188	14,975
Early Stuart Totals		(21,069)	(95,942)	(65,767)	(92,763)
Late Runs					
Kazchek Creek	Sept. 20-25	92	40	—	100
Middle River	Sept. 20-25	972	873	6,704	18,111
Tachie River	Sept. 24-25.	576	360	7,525	10,940
Late Stuart Totals		(1,642)	(1,535)	(14,229)	(31,918)
NORTHEAST					
Upper Bowron River	Aug. 28-Sept. 5	31,695	25,497	29,700	35,000
TOTALS **		1,353,640	747,523	990,716	1,407,828

* Numbers for some populations have been revised from the respective Annual Reports.
** Totals include small numbers of fish in small tributaries not listed in the table.

TABLE X

DAILY CATCH OF PINK SALMON, 1975-1977-1979-1981 FROM UNITED STATES CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	1975	1977	1979	1981	1975	1977	1979	1981	1975	1977	1979	1981
1						1,040				17,172		35,858
2									280,698			461,655
3								3,229			306,247	3,835
4								13,656		1,641	59,389	
5		220		32			14,791	11,571		152,848		
6		203		110		854	33,009	13,013		10,868		
7	307	71		23		8,841	34,056	4,538				18,918
8	308	189		91		109		6,772	53,910			471,496
9	324					8,300		18,899	32,018			40,374
10						644		21,083				36,505
11				200	19,933			26,709				4.353
12				666	16,127			12,446				24,795
13				164			42,539	10,487		219		105,752
14	1,066			256	23,762	1,796	132,837	11,252	146,806			53,736
15	840					46,828	113,410		132,744			6,130
16		1,776	4,266			70,333			57,264	5,344	12,762	7,113
17		409	925							55	70,785	35,350
18			1,608		55,608			165,098			3,790	11,586
19					52,909		7,602	177,216		36	1,620	1,462
20				2,609	53,815		476,678	88,850		2,042		337
21	8,328			2,325		23,559	478,797	79,974		1,623		4,793
22	5,047		5,203	4,100		446,813	95,190			995		7,447
23			13,237			246,590	345,863		12,387			3,024
24		2,163	8,198			275,569	60,371		4,707			
25		4,015				21,322	28,794	483,314				
26		1,363			137,643	20,728	548,344	498,424		743		
27				9,255	91,649		457,938	115,077		780		
28	12,707			3,202			35,947	136,034		243		
29	8,891					9,689	347,355	170,459	2,431			
30	7,998	422	12,529			360,684	15,619	273,423	866			
31	8,130	4,657	3,019			250,303	12,722					
Totals	53,946	15,488	48,985	23,033	451,446	1,794,002	3,281,862	2,341,524	723,831	194,609	454,593	1,334,519
Troll	7,881	40,202	34,918	35,736	11,946	118,162	224,700	139,418	956	4,394	2	479
Monthly Totals	61,827	55,690	83,903	58,769	463,392	1,912,164	3,506,562	2,480,942	724,787	199,003	454,595	1,334,998
June & Oct. Totals									3,149	1,573	1,213	862
Season Totals									1,253,155	2,168,430	4,046,273	3,875,571

TABLE XI

DAILY CATCH OF PINK SALMON, 1975-1977-1979-1981 FROM CANADIAN CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	**1975**	**1977**	**1979**	**1981**	**1975**	**1977**	**1979**	**1981**	**1975**	**1977**	**1979**	**1981**
1						12,490			33,756	50,134		
2						5,713			61,793			
3								234				
4		75			470			5,331			49,036	
5					199				78,851	30,598		
6						1,433	75,235		74,730	108,270		248,776
7	50					23,843	499	758	50,627			150,069
8						20,702			58,485	69,472		121,764
9	11		66		186	24,390						52,801
10					70	693						48,062
11					165			747				
12					121		1,547	77,045		28,051		
13		172					119,176	101,425		1,279		
14	18						155,509		62,355	44,759		154,919
15						207,768			45,604			
16			165			116,168	2,886		33,961			
17									29,163		6,309	
18					6,347			93,787	58,966		3,678	
19					11,200			105,277		548		
20		173		260	9,559		317,597			126		
21	243	152			14,836		240,369			9,285		
22	130				9,634	37,831	98,272	4,006	45,221			
23			182			136,178	2,467		2,800			
24	Strike					55,838		226,658				
25	July 25-	4,633			96,884		623,102	293,375	10,910			
26	Aug. 24	120			85,765		384,563	237,385	14,358			
27	712			12,232	94,303		244,486					
28	382											
29						3,685		384,824	11,317			
30			175				257,934	432,006	508			
31						87,617		389,248				
Totals	1,546	5,325	588	12,492	329,739	734,349	2,523,642	2,352,106	659,047	342,522	59,023	776,391
Troll	72,114	274,529	129,511	123,278	56,040	604,639	1,297,321	667,981	99,598	45,067	35,543	249,699
Spring Salmon Gill Nets									14,358	3,527		
Monthly Totals	73,660	279,854	130,499	135,770	385,779	1,338,988	3,820,963	3,020,087	773,003	391,116	94,566	1,026,090
June & Oct. Totals									23,448	65,520	85,327	5,906
Season Totals									1,255,890	2,075,478	4,131,355	4,187,853

TABLE XII

SUMMARY OF THE PINK SALMON ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS

District and Streams	*1981 Period of Peak Spawning*	*Estimated Number of Pink Salmon*			
		1975	1977	1979	1981
EARLY RUNS					
LOWER FRASER					
Main Fraser	Oct. 7-14	315,049	775,016	1,521,856	2,252,368
FRASER CANYON					
Coquihalla River	Oct. 8-13	5,933	2,821	16,468	24,029
Jones Creek	Oct. 3-12	2,645	3,350	4,993	4,485
Misc. Tributaries	Oct. 1-13	948	3,687	4,149	14,720
SETON-ANDERSON					
Seton Creek	Oct. 4-10	209,734	341,256	549,512	519,393
Upper Seton Channel	Oct. 12-16	7,995	11,122	9,956	10,402
Lower Seton Channel	Oct. 12-18	23,874	37,163	34,494	33,846
Portage Creek	Oct. 7-12	28,454	19,904	51,842	18,733
Bridge River	Oct. 10-13	10,803	25,800	65,759	43,940
Gates Creek	Oct. 16-18	—	96	1,277	88
THOMPSON					
Thompson River and Tributaries	Oct. 5-16	480,350	972,941	885,402	1,166,348
TOTALS *		1,085,985	2,193,156	3,154,945	4,097,269
LATE RUNS					
HARRISON					
Harrison River	Oct. 15-20	180,052	126,782	269,858	314,519
Chehalis River	Oct. 15-17	2,356	2,613	2,067	169
Weaver Creek	Oct. 16-20	411	2,397	117	1,006
Weaver Channel	Oct. 10-15	1,201	963	737	1,287
CHILLIWACK-VEDDER					
Chilliwack-Vedder River	Oct. 12-20	81,137	48,561	124,041	68,601
Sweltzer Creek	Oct. 23-26	16,121	5,093	8,889	5,213
TOTALS *		281,278	186,409	405,709	391,067
GRAND TOTALS *		1,367,263	2,387,811	3,560,654	4,488,336

* Totals may include small numbers of fish in small tributaries not listed in the table.

COMMISSION PUBLICATIONS, 1982

1. Annual Report of the International Pacific Salmon Fisheries Commission for 1981.

STAFF PUBLICATIONS IN OTHER JOURNALS

1. Studies related to biological detoxification of kraft pulp mill effluent. IV. The biodegradation of 14-chlorodehydroabietic acid with *Mortierella isabellina* by J. P. Kutney, E. Dimitriadis, G. M. Hewitt, P. J. Salisbury, M. Singh, J. A. Servizi, D. W. Martens, R. W. Gordon. Helvetica Chimica Acta. 65 Fasc. 5, p. 1300-1343 (1982).

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H. North	1955-1960
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M. Guns	1969-1971 1975-1979
W. Edwards	1971-1973
M. Ellis	1973-1975
John Makowichuk	1979-

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Nick Carr	1976-

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A. Downs	1980-

Native Indians

D. Guerin	1981-

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Salmon Processors

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J. Lind	1980-

Purse Seine Fishermen

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N. Mladinich	1946-1976
W. Green	1976-

Gill Net Fishermen

C. Karlson	1938-1958
J. F. Jurich	1946
J. Erisman	1958-1964
V. Blake	1964-1967
R. Christensen	1967-1982
R. Suggs	1982-

Troll Fishermen

S. Leite	1938-1945
E. Larum	1939-1943
C. J. Dando	1946-1948
A. Anderson	1948-1949
J. R. Brown	1949-1957
B. J. Johnson	1958-1962
F. Bullock	1962-1966
C. Mechals	1966-1972
F. Lowgren	1972-1973
G. D. Simmons	1973-1981
W. Kimzey	1981-1982
C. Finley	1982-

Reef Net Fishermen

J. R. Brown	1958-1974
G. H. Schuler	1974-1978
T. Philpott	1978-

Sports Fishermen

K. McLeod	1938-1953
H. Gray	1953-1972
E. Engman	1972-

Native Indians

C. Peterson	1981-

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Consultant (from April)

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